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PAPERS

IN

AGRICULTURE.

The GOLD MEDAL *of the Society being the Premium offered for planting* OAKS, *was this Session adjudged to the Right Hon. the* EARL OF MANSFIELD, *from whom the following Communications were received.*

SIR,

ON behalf of Lord Mansfield, as a candidate for a premium for raising oaks, since the year 1803, I beg leave through you to submit the following statement to the Society of Arts, &c. viz.

That since the year 1803, I have raised and planted for the Earl of Mansfield at Scone, near Perth, Perthshire, 96,000 oaks, part of them raised from acorns in his lordship's nursery, and part from young plants; the whole of them are properly fenced with hedge and ditch, and where that was impracticable, with strong paling. Part of the ground planted consists of steep banks on the side of a brook, and the river Tay, the remaining part common moor—the banks were made and planted in the common way—the moor, was planted after a different manner: the whins, or furze, with which it was partly covered, were burnt, and the land ploughed as well as the nature of it would admit, (being very rough and stony,) in the autumn 1804, and summer 1805, and before planting laid up in ridges of four feet breadth, which, with some open drains cut through them, laid the whole completely dry, and the oaks were put in on the top of the ridges.

The above treatment was suggested to me by Lord Mansfield, and is, I believe, a new mode, which has met with the approbation of every one who has seen it, as it lays the land dry, and prevents the young plants being thrown out by the frost in winter, to which, by the nature of the soil and climate here, they are very liable to. It lays a greater quantity of surface mould round them, in which they grow freely while young, and although a bad soil, the whole are in a more healthy and thriving state than other plantations near them; as the following certificate from experienced and respectable nurserymen and gardeners will show, who have viewed the whole, in order to certify the state they are in, agreeable to the Rules of the Society.

Any further statement or explanation deemed necessary will be readily furnished by addressing a line to me, gardener to the Earl of Mansfield at Scone near Perth.

I am, Sir,
Your most obedient servant,
WILLIAM BEATTIE.

Scone Gardens, 18th Dec. 1807.
To C. Taylor, M.D.
Secretary to the Society of Arts, &c.

Certificate

Certificate of the Truth of the foregoing Statement.

WE the undersigned having viewed the plantations referred to in the foregoing report, do hereby certify that they are in a healthy and thriving state, (in particular those on the common moor,) that there is at least 500 plants per acre in that state, and the whole are fenced as represented.

JOHN BURTON, *late Gardener to Earl Ferrers.*
ROBERT BROWN, Nurseryman, Perth.
JAMES BROWN, ditto.

A Certificate to the same effect, was likewise received by the Society, signed by the Rev. WILLIAM AITKIN, Minister of the Parish of Scone.

The GOLD MEDAL *of the Society being the Premium offered for planting* LARCHES, *was this Session adjudged to the Right Rev. the* LORD BISHOP OF LANDAFF, *for planting* 322,500 LARCH TREES, *near Newby Bridge, Lancashire, from whom the following Accounts and Certificates were received.*

SIR,

IN 1789, I was honoured by the Society with a Gold Medal, for having planted forty-eight thousand larches on a high barren mountain, called Wansfel, near Ambleside. This was the first plantation which had been made in this country on such an exposed situation, and I was told by every body that it would never thrive. I have great pleasure, therefore in assuring the Society that it flourishes beyond my expectation. The trees on an average now measuring above eleven inches in circumference, at six feet from the ground.

I herewith transmit to you a certificate of my having planted on two contiguous mountains, called Birkfell and Gomershow, situated near the foot of Winandermere, three hundred and twenty-two thousand five hundred larches; and a certificate also signed by two most respectable gentlemen of the present state of the two plantations. I do not know the exact height of either of these mountains, but Gomershow is seen at a great distance in every direction, above the rest of the mountains on the borders of the lake, and the surface of the lake is more than one hundred feet above the level of the tide at high water.

I have some expectation of coming into possession of a large portion of land on the top of Skiddaw, a mountain near Keswick, one thousand and ninety yards in height; and if I should succeed in this expectation, it is my intention to plant it with larches, that I may leave to posterity either a convincing proof that in this climate the larch tree will flourish on the highest mountains in Great Britain, or a mark of my folly, to warn others from attempting to render land so situated beneficial to the state, and to themselves, by planting it.

Many men are deterred from planting by an apprehension of the expense attending the requisite fencing, but this expense is not great when a plantation is large, and the fence is situated on the acclivity of a hill, for the rise of the hill will very much reduce the height of the wall, especially if the earth be hollowed out three feet in breadth, a foot in depth, and at a foot and one-half distance from the wall.

A square mile of fence incloses six hundred and forty statute acres, and the same extent of fence (7040 yards) will inclose a circle containing eight hundred and fourteen acres, and may in most countries be made at less than sixpence a yard, lineal measure, or little more than four shillings an acre for 814 acres; and the areas of similar figures being as the squares of their homologous sides, a circular fence of double the extent here mentioned would inclose four times 814 acres.

With my best wishes for the prosperity of a Society which has in various ways rendered great service to the community,

I am, Sir,
Your faithful Servant,
R. LANDAFF.

Calgurth Park, Kendall,
October 17, 1807.
To C. Taylor, M. D. Sec.

I, Robert Atkinson, do hereby certify, that between the 27th day of Nov. 1804, and 6th day of April 1805, I planted with proper assistance for the Bishop of Landaff, one hundred and twenty-two thousand five hundred larches, on a mountain called Birkfell, situated near Newby-bridge, in the parish of Cartmel, and county of Lancaster. And I do hereby further certify, that between November 1805 and the 25th of March 1806, I planted for the said Bishop on a mouna mountain called Gomershow, adjoining to Birkfell, two hundred thousand larches. The larches of both plantations had been transplanted one or two years, and were from 12 to 24 inches in length; the trees were planted in rows at the distance of six feet from each other, and the plants in each row were at the same distance, where rocks would permit. Holes in the ground were made with a hack, and the plants were well trodden down. The plantations are well fenced with stone walls, and the trees are now in a flourishing condition.

ROBERT ATKINSON.

Oct. 13th, 1806.

Certificates were received from JEREMIAH DIXON, Esq. of Fellfoot, and WILLIAM TOWNLEY, Esq. of Townhead, dated Oct. 12th 1807, declaring the above accounts to be true and correctly stated; that they had lately viewed the ground, and found the plants in a very thriving condition.

The GOLD MEDAL *of the Society, being the Premium offered for gaining the greatest Quantity of* LAND *from the Sea, was this Session adjudged to the Right Hon.* LORD BORINGDON, *from whom the following Accounts were received.*

SIR,

OBSERVING in the last Volume of the Transactions for the Encouragement of Arts, Manufactures, and Commerce, that amongst the various Premiums offered by the Society, a Premium is proposed to "the person who shall produce to the Society an account, verified by actual experiment, of his having gained the greatest quantity of land from the sea, not less than 50 acres, on the coast of Great Britain and Ireland, and that the work was commenced subsequently to the 1st of January 1800." I have the honour to acquaint you, that by means of an embankment, which was begun in the spring 1806, I have obtained from the sea 175 acres.

The land which has been gained was formerly called Chelson Bay, and was overflowed twice every 24 hours by the tide of the sea. For the construction of the embankment I contracted with Mr. James Green, Engineer, of Birmingham, a gentleman of very distinguished science in the profession to which he belongs, and to whose unceasing zeal and attention I attribute the success of the work. The embankment is about 970 yards, or 2910 feet in length, the average height above the surface of the mud is about 16 feet perpendicular, at which height it is considered to be two feet above the highest tide ever known; the average width of the base is about 91 feet, the width at top three feet, the slope on the outside (next to the sea) is covered with limestone paving, underneath which is a water-tight puddle of about three feet thick, which prevents the water penetrating in any part; the inside slope is soiled and sown with grass seeds. It was originally intended to give the surface of the embankment (next to the sea) a regular slope throughout, of four feet horizontal to one foot perpendicular, and to make the inside slope as one foot six inches horizontal to one foot perpendicular; but, in the progress of the work, it was ascertained that the embankment would require to be raised two feet higher than had been at first apprehended, and it became necessary to widen the base in order to increase the height; and as the front slope was then in great part paved, this could best be done on the inside.

On adding this additional weight of earth to the embankment, the mud on which it was founded gave way, in such a manner as to render it next to impossible to continue the slopes in the form first intended; in order therefore to rest, as much as possible, the additional weight on the great body of materials, it was determined to give the last three feet in height a slope of two feet horizontal to one foot perpendicular, (in front,) joining it to the flatter part of the slope to avoid a direct angle by giving it a concave appearance; the width of the top of the embankment is continued three feet, and the inside slope is increased to five feet horizontal to three feet perpendicular. This alteration appears to have had the desired effect.

The water coming from the high lands on each side of the land embanked, is collected in a drain cut for that purpose, and carried over the embankment. The rain which may fall on the surface of the mud land, as well as the spring-water rising therein, is carried off by means of a sluice of three feet by two feet area, composed of the best three-inch oak plank, framed together and supported by piles and cross beams; the bottom of this sluice is on a level with the low-water mark of the highest spring tides.

The land gained is, for the most part, rich argillaceous loam, in many places 20 feet deep, and at present greatly impregnated with marine salt. Nearly one-third of the land has already been ploughed. The abundant rains which in the winter season usually fall in this part of England, and the being enabled to float with fresh water a considerable portion of the new land, lead me to think that by next spring the marine salt will, in a great degree, be extracted, and that in June the land will be fit for sowing. The Secretary of the Board of Agriculture has, upon my application to him, been so obliging as to point out to me the only written detailed accounts of similar experiments, and of the subsequent treatment of the lands acquired. Those details to which he referred me are to be found in Vol. IV. p. 49, of the Transactions of the Society of Arts; in his own Annals of Agriculture, Vol. II. p. 82; and his Norfolk Report, p. 438. As all these accounts concur in stating that the respective new lands have been sown with rape, and also that abundant crops had ensued, it is my intention to sow in June next the greatest part (though probably not the whole) of the land in question with that seed, and I entertain but little doubt of having as favourable crops as those which are mentioned in the papers to which I referred. The Plymouth Road Company having recently, by public auction at Plymouth, sold at the rate of 130*l.* per acre 30 other acres of newly-gained land (called Tolhill Bay), which (with exception that no part of them is yet ploughed, and that the soil itself is considered as inferior to mine) is precisely in the same condition as mine, and nearly about the same distance from Plymouth, I consider that the land which I have gained would, if now offered for sale, produce about 25,000*l.* The expenses of the work have amounted to about 9000*l.* I have also within two years gained, by an embankment from the sea, 40 acres of land at Charlton, near Kingsbridge, in this county, making in the whole 215 acres.

I have the honour to be, Sir,
Your obedient humble Servant,
BORINGDON.

Saltram, Nov. 19, 1807.
To C. TAYLOR, M.D. SEC.

The following Certificates of the truth of the foregoing statement, have been received by the Society, with the respective signatures, as annexed.

Nov. 19, 1807.

We hereby certify, that by a map, which we have every reason to think accurate, Chelson Bay contains about 175 acres; that the said bay was, previous to the new embankment, regularly overflowed by the tide of the sea; that the embankment now excludes it from such overflow; that a considerable part of the new land is already ploughed, and that the embankment was begun subsequently to the 1st of January, 1800.

John Harris, Radford.
John Arscott, Clerk, Plympton.
Rev. William Hayne, Minister of Plympton St. Mary's.
R. Williams, Surgeon, Plympton.
E. Start, Pomplett.
T. Norris, Tozer Wixenford.
Isaac Blackburn, Turnchapel.
Richard Worth, Herdwick.

A Certificate, testifying that the tide of the sea overflowed about forty acres of mud land at Charlton, near Kingsbridge, previous to Lord Boringdon's making the new embankment there, and that such embankment now excludes it from such overflow, and that it was begun subsequently to the 1st of January, 1800.

Richard Chaffon.
John Yolland, Merrifield.
William Pearce, Charlton.

The Silver Medal *of the Society was this Session adjudged to* William Lawrence, *Esq. of Maldon in Essex, for gaining* Land *from the Sea. The following Communications were received from him, and a Map of the Land is preserved for Inspection in the Society's House.*

SIR,

The Certificate which accompanies this letter will I believe give you all the particulars necessary for a claim I now presume to make, for gaining land from the sea.

In the summer of 1806, I applied to the Dean and Chapter of St. Paul's, for a lease of the saltings now inclosed, which were part of the demesne lands of their manor of Heybridge Hall, near this town, and which (after they had given their tenant the offer, and he had refused to have them, alledging they were not worth the expense of inclosing) they consented to grant, and have now demised to me, for twenty-one years from Michaelmas last, at the rent of five pounds, renewable every seven years, on payment of a fine, and in the usual form of church leases; and notwithstanding the land is only leasehold, I trust the inclosure will well answer my expectation, although the greatest advantage will be derived by the Dean and Chapter of St. Paul's, for I have not only added near one hundred acres of land to their estate, but by the erection of a new bank or sea wall, they get a foreland to their former estate secured by it, instead of an old rotten bank, which in my opinion was insecure; and the land now leased to me was of little or no value to their tenant.

My first application to them was not for the land now inclosed, but for other saltings very near the town of Maldon, but as they were already promised to another person, with other lands to which they had always been annexed, my wish could not be complied with. It is the prevailing opinion of this neighbourhood, and generally supposed correct, that the stagnated water in the *pans*, as they are called, or holes in the saltings, along with the exhalations from the uninclosed lands, and oose or mud near the river, occasion the agues to which this neighbourhood is subject, and my motive for applying for the saltings near the town, was as much for the benefit of the health of my neighbours as for my own emolument.

It really would be very beneficial if the Dean and Chapter would make some allowance to their tenant, to enable him to embank this piece, for it would greatly improve their property, and benefit the town, to which at present it is a great nuisance; and as the work would be expensive, the tenant cannot be expected to do it without some compensation. I shall in some degree contribute to the health of the neighbourhood by my embankment; but not to the extent I should have done, had a lease of the other part been granted to me.

A plan of the new wall and a map of the land accompany the certificate: you will observe by the latter, that if I could have run the wall across the creek, or the north-east of the land, near Burrow Hills Mill, it would have saved forty rods of walling; but that was not practicable on account of the water which supplies the mill, ebbing and flowing through this creek or channel, at the end of which is a salt office, to which barges laden with rock salt pass and repass, and therefore the navigation could not be stopped.

On the land inclosed are several hills, which are supposed to be Tumuli, thrown up by the Danes after the desperate battle fought here when they invaded this kingdom. These are now intended to be mixed with chalk, and spread on the land as manure.

This land will have an advantage which very few salt marshes possess, as I have now the liberty of diverting a water-course, which will not only supply every part of it, at all times, with good spring-water from Tiptree Heath, but will also fill the ditches of the adjoining lands, which were generally dry in summer.

The whole wall and sluices were completed in ten weeks, although the work was delayed by a very high tide on Christmas-day last, which run over a part of the wall before it was completed, and gullied it in several places; but no material damage was done, although the wall was not so high as at present, by nearly two feet.

The late high tide, on the 30th September last, did not rise to the height of the wall in any part, not even where the rills had been stopped, and where it had sunk considerably, but since raised, although it run over several old embankments in the neighbourhood, inundated the lands, and did much damage in Essex.

I am, Sir, with great respect,

Your obedient Servant,

WILLIAM LAWRENCE.

Maldon, Nov, 2, 1807.

To C. Taylor, M.D. Sec.

We,

CERTIFICATES.

We, whose names are hereunder written, the Vicar, Churchwarden, and Overseer of the parish of Heybridge, in the county of Essex, hereby certify, that a piece of land, in the parish aforesaid, called the Saltings, containing ninety-nine acres, two roods, and twenty-three poles, has, within the last twelve months, been inclosed by Mr. Wm. Lawrence, of Maldon, from the Black Water river or bay, which is an arm of the sea; and that the land so inclosed is greatly improved thereby, and will shortly become valuable, being well secured from inundation of the sea, by which it has heretofore been overflowed at spring tides.

We further certify, that the embankment is in length two hundred and ninety rods, the base whereof is twenty feet; its height five feet; and the width at the top four feet; the slope on the side next the sea is ten feet, and on the land side six feet; and there is also a good foreland towards the sea. The said embankment is made of soil only, and there are two sluices or gutters under it, which drain the land inclosed. We believe the whole expense of inclosing the said saltings (exclusive of marsh ditches, gates, &c.) to be as follows, viz.

	£.	s.	d.
To 290 rods of walling or embanking, at 1*l.* 6*s.* per rod . . .	370	0	0
To planks, barrows, and tools .	50	0	0
To a sluice or gutter, 46 feet long, and 2 feet clear run . . .	51	3	7½
To one do. repaired, 46 feet long, and 18 inches run . . .	28	8	6
To cartage and extra charges . .	7	18	10
	£. 507	10	11½

In addition to the above expenses, a considerable sum has been paid for levelling the rills and holes, and in making marsh ditches, gates, &c.

Signed by

FR. J. WARING, A. M. Vicar.
R. FRANCIS, Churchwarden.
RT. CLARK, Overseer.
JAMES SHYNM.
D. P. FRANCIS.

Maldon, Oct. 28, 1807.

SIR,

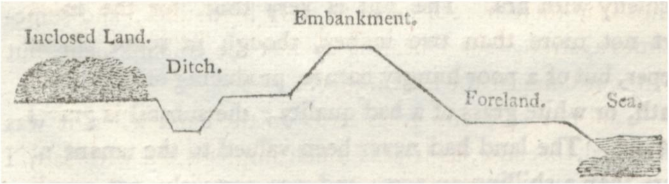
IN answer to your letter of the 1st instant, I have to inform you, that the embankment is made of soil only, but it is not thrown loosely together, it is composed of the earth which was taken and produced by making a ditch on the land side of the embankment, and from the green sward and soil taken from off the foreland on the sea-side. This earth was thrown together to form the wall or embankment, and after every layer, well rammed or pounded together by the workmen. It was made so firm and consistent as not to have sunk perceptibly, except where some deep creeks and rills were filled up, which are now made good. Since finished, there have been some very high tides, and sometimes a strong surge beating against the embankment, but without doing it the least injury.

I did not sow any grass seeds on the bank when it was finished, because, as it was much impregnated with salt, I considered that it would be scorched up by the summer heat, even if it should begin to vegetate; but as it has now been exposed to the sun and air for a whole summer and winter, I intend sowing grass seeds thereon, where there is no herbage already. This is not customary here, for the land is generally left to nature, and frequently many years elapse before a natural green sod is formed, and that is commonly a species of twitch grass. By sowing it with grass seeds, I expect in a year or two to have some good sheep-food upon it. Mr. Waltham, and several gentlemen experienced in works of this kind, have inspected this embankment, and think it exceedingly well done. Six or seven acres of the land thus inclosed were ploughed up early in the last winter, and the quality of the soil appears to be excellent; this part is now sown with black oats, and if the experiment answers, more of the land will be broken up next winter.

I remain, Sir,
Your obedient Servant,
WM. LAWRENCE.

Maldon, April 4th, 1808.

To Charles Taylor, M. D. Sec.



The GOLD MEDAL *of the Society was this Session adjudged to* A. BAIN, *M. D. of Curzon Street, for planting* 338,199 *Forest Trees, at Heffleton, in Dorsetshire. The following Communications were received from him.*

SIR,

I BEG leave to inform you, that in the year 1798, I began to make plantations of forest trees on a small scale at Heffleton, in the county of Dorset, on ground which was, in general, valued at 5s. an acre; and previously to the year 1804, I had covered about 50 acres of such land with trees which are considered to thrive as well as any in that neighbourhood. No accurate account has been kept of the number and sorts, but making allowance for the difference of ground, they were planted much upon the same plan as those which I shall proceed to detail, except that they were thicker together, and were probably 3000 to an acre, making in the whole 150,000 trees.

Encouraged by my success, I inclosed 250 acres of heath ground, with a bank and ditch, for the purpose of planting it chiefly with firs. The soil is very thin, for the most part not more than two inches, though in some places deeper, but of a poor hungry nature, producing only stunted heath, or white grass of a bad quality; the subsoil is gravel or sand. The land had never been valued to the tenant at more than a shilling an acre, and was certainly not worth more. The bank and ditch were made by the perch, at the expense of 1s. 6d.; small furze plants were put in the face of the bank at 1s. 8d. per thousand; and furze seed afterwards sown to fill up the drills where the plants had failed, or in some places to form a future fence. When the planting was begun, a dead hedge was made on the top of the bank; or fence hurdles, six feet long, and two feet high, were placed on its summit, to prevent the heath sheep, which are active and enterprising, from getting into the plantations before the furze, by its growth, should have completed the security of the fence. Two thousand trees and upwards were allotted to each acre, and the ground was prepared for receiving them in the following manner: A round thin piece of turf, from one and a half to two feet in diameter, was pared off with a sharp spade or an axe-hoe, and thrown away. This small spot of ground, divested of its heath, was then dug and chopped one foot deep with a spade, or if hard and stony, with an axe-hoe, by which the roots of the heath were completely divided; and these little spaces of ground, without taking out any of the earth, were allowed to rot and mellow one or two years before they were filled with plants. This preparation cost little more than a guinea an acre; and, in similar soils, I can recommend it with much confidence. As most of the ground was elevated, and exposed to the strong sea winds of the south coast, which is only four or five miles distant, the planting was begun to the south-west of the whole with Scotch firs, intermixed with some spruce and pinaster, having convinced myself, by repeated trials, that no other trees would succeed so well in that soil and exposure. The firs were raised in my own nursery, or in the immediate neighbourhood, or were procured from Mr. Whitley of Brompton; and in either case, having been transplanted, and allowed to remain at least one season in my own nursery, they and the others were planted out in general at three years old. The deciduous trees were mostly raised by my gardener, and were excellent of their kinds. About 180 acres were planted between the first of October 1804, and the first week in December 1805; and the number of trees planted in that time was 338,199, as the annexed list will show:

Scotch fir, 289,555; oak, 4,362; larch, 12,290; Sp. chesnut, 5,647; spruce, 3,450; ash, 11,050; pinaster, 1,900; sycamore, 4,050; birch, 1,700; hazel, 4,195.

It should be observed that the roads, some of which are thirteen yards wide, are included in the portion of heath above stated. The plantation, for so poor a soil, has succeeded remarkably well. The firs, except the larch, are in a healthy thriving state, and the pinasters grow nearly as fast again as the others. It will be seen by the above account, that the oak, chesnut, and larch bear a small proportion to the Scotch firs, and I have only reason to regret that their proportion was not still smaller; for although they were planted in the best soil and most sheltered places, they have a very unpromising appearance. The larch, with some exceptions, were planted in declivities and gravelly vallies, screened by hills to the south-west from the influence of sea air and blowing winds. They seemed to thrive the first season after planting, yet most of them sickened the second, and died the third; but in lands of a better quality than the inclosure I have described, no tree succeeds with me better than the larch, whatever the exposure may be. The ash and sycamore grow slowly, but I flatter myself that when the firs are sufficiently advanced to shelter them, I shall not have planted them in vain. Next to the Scotch firs and pinasters, the birch thrives best in every part of my heath, and seems equally regardless of the poverty of the soil, and of the influence of sea winds.

Should the efforts I have made to cover a barren part of the country with trees, entitle me to the honorary premium of the Society, or be deemed worthy of notice in their Transactions, I would take the liberty, through so excellent a medium, to advise the inexperienced planter to receive with caution any recommendation to form plantations of larch on the barren heathy surfaces in the southern counties of England.

I have the honor to be, Sir,
Your obedient humble servant,
A. BAIN.

Curzon Street, Nov. 27, 1807.

P. S. The certificates I have obtained of the present state of the plantation, refer solely to those trees which were planted between the first of October 1804, and the first of April 1805, agreeably to the rules of the Society. But, had it been permitted, I could have brought similar testimony to the state of the trees which were planted later in the year 1805, since which period I have been engaged in planting land of the same description; so that from the year 1798 to the present time, I have planted upwards of 800,000 trees in 400 acres of ground.

Certificates of the truth of the foregoing statement have been received by the Society, signed by

NATHANIEL W. PEACH, Esq. of Dudbridge.
THOMAS BARTLETT, Esq. of Wareham.
RICHARD VINCENT, Gardener to Dr. BAIN, at Heffleton.

The GOLD MEDAL *of the Society was this Session voted to Mr.* CHARLES WAISTELL, *of High Holborn, for his Method of ascertaining the Value of growing Timber Trees, at different and distant Periods of Time. The following Communications were received from him,*

SIR,

CONCEIVING that the Tables contained in the annexed papers will afford useful information to growers of timber, and tend to encourage the growth of it in these kingdoms, and thereby promote the views of the Society of Arts, &c. I trust you will have the goodness to lay them before the Society, as I have formed them with great attention.

Having last autumn viewed some plantations made under my direction about thirty years ago, I found the value of one of them much to exceed my expectation. I became therefore desirous to devise some means of estimating what its value might probably be at different future periods. I was thus led to construct the first of these tables, and on the completion of this, other tables seemed necessary, and I was thus progressively led on to the construction of the whole. For this purpose I searched in various authors for the measure of trees, in girt and height, at different ages, and obtained similar information among my acquaintance. Hence I collected, that the increase in the circumference of trees is generally from about one to two inches annually, and from twelve to eighteen inches the annual increase in height. Some fall a little short, and some exceed those measures.

I shall now briefly notice a few of the advantages to be derived from the first Table.

1st. The first Table shows every fourth year, from twelve years old to an hundred, the rates per cent. per annum at which all trees increase, whether they grow fast or slow, provided their rate of growth does not vary. This table may be the means of saving young thriving woods from being cut down, by showing how great a loss is sustained by felling timber prematurely *.

2d. And it may be the means of bringing old trees to market, by showing the smallness of the interest they pay for the money they are worth, after they are 80 or 100 years old.

But this table shows the interest which they pay, only, whilst the trees continue growing at their usual rate. In case they fall short only a little of their usual increase in girt, this considerably diminishes the rate per cent. per annum of their increase. And trees do decrease in their rate of growth before they appear to do so †. A pale and mossy bark are certain indications of it.

3d.

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* "A wood, near West Ward, in Cumberland, of more than 200 acres, was felling in 1794, it was little more than 30 years old. The whole was cut away without leaving any to stand." *See Miller's Gardener's Dictionary, last edition, under the Head of Woods.*

At 30 years old timber pays 10 per cent. for standing, and probably this wood might have paid 7 per cent. per annum on an average for the next 30 years.

† In Mr. Pringle's Agricultural Report for Westmoreland is a paper of the Bishop of Llandaff's, stating, "That a very fine oak, of 82 years growth, measured in circumference at 6 feet from the ground, on the 27th of October 1792, 107 inches, and on the same day of the same month in 1793 it measured 108 inches." He then states the interest it paid to be only about 2 per cent. and says this tree

3d. The 1st Table may also assist the valuer of such timber as is not to be cut down, but to continue growing, by enabling him to estimate its present value more accurately than is usually done, especially when it is increasing after a high rate per cent. per annum*.

The 2d Table shows the rate per cent. to be the same as in the first Table, though the annual increase is more both in height and circumference.

The 3d Table is calculated to show the number of trees that will stand on an acre of ground, at the distance of one fifth of their height, (which distance is recommended by Mr. Salmon, in a paper in the Society's 24th volume,) and the number of feet the trees will contain, both those to be cut out, and those to be left standing, at the end of every four years, from 16 to 64 years old, supposing they increase 12 inches in height and 1 in circumference annually. This distance may suit fir trees, but will be too near for oaks.

The 4th and 5th Tables show the same particulars when the trees grow at greater rates.

The 6th Table is calculated to show the same particulars when the trees are constantly thinned out every four years, so as to leave them at the distance of one-fourth of their

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tree was a singularly thriving one. It is evident that, with all this appearance of thriving, it was on the decline. For if we divide 108, its inches in circumference, by 82, its age, we find its average annual increase had been 1 inch and a third. Its falling off to 1 inch reduced the rate per cent. of increase one-fourth.

* A fir wood of more than 60 acres, and about 30 years old, was lately valued to be sold with an estate, by several eminent wood valuers, without taking into consideration its rate of increase. It was then increasing after the rate of 10 per cent. per annum, and probably would increase after the rate of 8 per cent. on an average for the next 20 years.

height,

height. According to this table there will be 48 trees left on an acre when they are 120 years old; and it seems generally agreed, that from 40 to 50 full grown oak trees, are as many as have sufficient room to stand on an acre.

The 7th Table shows the same particulars respecting trees which increase 15 inches in height and 1½ inch in circumference annually.

The 8th Table shows the same particulars respecting trees which increase 18 inches in height, and 2 inches in circumference annually.

The 9th Table shows the same particulars as Table 6, till the trees are 28 feet high, after which the distance is increased from one-fourth to one-third of their height.

The 10th, 11th, and 12th Tables show the annual increase in boles of 24, 32, and 40 feet long, and the difference of their increase at the same ages.

To these Tables succeed comparative statements, showing the number of feet contained in boles of different lengths, when the trees are 60 years old; by which it appears, that, if cut down at that age, the longest boles are not the most profitable to the growers of timber.

And I have added the valuation of the plantations before alluded to, with remarks on them.

Having finished my introductory remarks, I conclude, and am, Sir,

Your very humble Servant,

CHARLES WAISTELL.

TABLES

TABLES RESPECTING THE GROWTH OF TIMBER.

CALCULATIONS, showing every fourth year, from 12 to 100, the progressive annual increase in the growth of trees, and gradual decrease in the rate per cent. per annum, that the annual increase bears to the whole tree.

The whole height of the trees is taken to the top of the leading shoot, and the girt in the middle; but no account is taken of the lateral branches.

If trees increase 12 inches in height and 1 in circumference annually, their increase will be as undermentioned, viz.

TABLE I.

Years old & ft. high	Girt.	Contents.			Years old & ft. high	Girt.	Contents.				One year's increase.				Rate per cent. of increase.
	inch.	ft.	in.	pts.		inch.	ft.	in.	pt.	sds.	ft.	in.	pt.	sds.	
12	1½	0	2	3	13	1⅝	0	2	10	3	0	0	7	3	26·8
16	2	0	5	4	17	2⅛	0	6	4	9	0	1	0	9	19·9
20	2½	0	10	5	21	2⅝	1	0	0	8	0	1	7	8	15·7
24	3	1	6	0	25	3⅛	1	8	4	1	0	2	4	1	13·
28	3½	2	4	7	29	3⅝	2	7	9	1	0	3	2	0	11·
32	4	3	6	8	33	4⅛	3	10	9	6	0	4	1	6	9·67
36	4½	5	0	9	37	4⅝	5	5	11	5	0	5	2	5	8·5
40	5	6	11	4	41	5⅛	7	5	8	10	0	6	4	10	7·6
44	5½	9	2	11	45	5⅝	9	10	7	9	0	7	8	9	6·96
48	6	12	0	0	49	6⅛	12	9	2	3	0	9	2	3	6·38
52	6½	15	3	0	53	6⅝	16	1	10	2	0	10	10	2	5·9
56	7	19	0	8	57	7⅛	20	1	1	7	1	0	5	7	5·4
60	7½	23	5	2	61	7⅝	24	7	6	6	1	2	4	6	5·1
64	8	28	5	4	65	8⅛	29	9	7	0	1	4	3	0	4·76
68	8½	34	11	4	69	8⅝	35	7	8	11	1	6	4	11	4·49
72	9	40	6	0	73	9⅛	42	2	6	4	1	8	6	4	4·2
76	9½	47	7	6	77	9⅝	49	6	5	2	1	10	11	2	3·98
80	10	55	6	8	81	10⅛	57	7	11	9	2	1	3	9	3·79
84	10½	64	3	8	85	10⅝	66	7	7	8	2	3	11	8	3·6
88	11	73	10	4	89	11⅛	76	5	11	1	2	7	7	1	3·5
92	11½	84	5	9	93	11⅝	87	3	4	0	2	9	7	0	3·3
96	12	96	0	0	97	12⅛	99	0	4	6	3	0	4	6	3·15
100	12½	108	6	0	101	12⅝	111	9	6	8	3	3	6	8	3·

In Table X. of the increase of a bole of 24 feet in height, of a tree growing at the above-mentioned rate, it will be observed, that the contents at 24 years of age are the ſame, and at 64 years nearly the same as in the above Table, but the contents of the bole at all the intermediate periods exceed the above. And a 40 feet bole exceeds the above contents from 44 years to 100, as may be seen in Table 12.

For these reasons chiefly I did not think it necessary to take into consideration the decrease in height that takes place in trees at different ages, according to the kind of tree and quality of the soil.

The increase per cent. per annum is the same as the above in all trees at the same age, whether they have grown faster or slower, provided their increase in height and thickness annually has not varied on an average. The progress of trees is sometimes greatly retarded by insects destroying their leaves, by unfavourable seasons, and by their roots penetrating into noxious strata. But these accidents cannot enter into calculations.

CALCULATIONS, showing every fourth year from 12 to 64, the progressive annual increase in the growth of trees, and the gradual decrease in the rate per cent. per annum that the annual increase bears to the whole tree.

The whole height of the trees is taken to the top of the leading shoot, and the girt in the middle; but no account is taken of the lateral branches.

If trees increase eighteen inches in height, and two inches in circumference, annually, their increase will be as undermentioned, viz.

TABLE II.

Age of Trees.	Height	Girt.	Contents.			Age of Trees.	Height	Girt.	Contents.				One year's increase.				Rate pr cent. of increas.
	feet.	in	ft.	in.	pt.		feet.	inch	ft.	in.	pt.	sd.	ft.	in.	pt.	sd	
12	18	3	1	1	6	13	19½	3¼	1	5	1	0	0	3	7	0	26·5
16	24	4	2	8	0	17	25½	4¼	3	2	4	0	0	6	4	0	19·8
20	30	5	5	2	6	21	31½	5¼	6	0	3	6	0	9	9	6	15·6
24	36	6	9	0	0	25	37½	6¼	10	2	0	6	1	2	0	6	13·
28	42	7	14	3	6	29	43½	7¼	15	10	6	0	1	7	0	0	11·
32	48	8	21	4	0	33	49½	8¼	23	4	8	0	2	0	8	0	9·6
36	54	9	30	4	6	37	55½	9¼	32	11	7	6	2	7	1	6	8·5
40	60	10	41	8	0	41	61½	10¼	44	10	3	6	3	2	3	6	7·6
44	66	11	55	5	6	45	67½	11¼	59	3	10	0	3	10	4	0	6·9
48	72	12	72	0	0	49	73½	12¼	76	7	1	0	4	7	1	0	6·3
52	78	13	91	6	6	53	79½	13¼	96	10	11	6	5	4	5	6	5·8
56	84	14	114	4	0	57	85½	14¼	120	6	8	6	6	2	8	6	5·4
60	90	15	140	7	6	61	91½	15¼	147	9	2	0	7	1	8	0	5·
64	96	16	170	8	0	65	97½	16¼	178	9	4	0	8	1	4	0	4·7

Explanation

Explanation of the Construction of Tables I. and II.

To render the preceding tables easy to be understood by persons not accustomed to calculations, I will state the process of the operations in the first line of Table II.

The height of the tree at 12 years of age is supposed to be 18 feet to the top of its leading shoot, and 24 inches in circumference at the ground, consequently, at half the height, the circumference is 12 inches,—one-fourth of this, being three inches, is called the girt. The girt being squared and multiplied into the height, gives one foot one inch and six parts for its contents. At 13 years old the tree will be 19½ feet high, 26 inches in circumference at the ground, and 13 inches at half the height; one-fourth of 13 gives 3¼ inch for the girt. This squared and multiplied into the height, gives one foot five inches and one part for the contents. Deduct from this the contents of the tree at 12 years of age, and there remains three inches and seven parts, which is the increase in the 13th year. Then reduce the contents of the tree when 12 years old, and the increase in the 13th year, each into parts, dividing the former by the latter, and the quotient will be 3·76; by this number divide 100, and the quotient is 26·5, which is the rate per cent. of increase made in the thirteenth year; consequently whatever the tree might be worth when 12 years old, it will, at the end of the 13th year, be improved in value after the rate of 26*l.* 10*s.* per cent. or in other words, that will be the interest it will have paid that year for the money the tree was worth the preceding year.

At every succeeding period, both in this Table and Table I. the like process is gone through.

Observations

Observations on Tables I. and II.

The preceding tables furnish us with the following useful information, viz.

1st. That all regular growing trees, measured as above, as often as their age is increased one-fourth, contain very nearly double their quantity of timber.

2nd. That when a tree has doubled its age, its contents will be eight-fold.

3d. That when a tree has doubled its age, the annual growth will be increased four-fold.

4th. Consequently that when a tree has doubled its age, the proportion that its annual increase bears to the contents of the whole tree, is then diminished one-half.

This last observation explains how it comes to pass that a tree, when its age is doubled, the rate per cent. per annum that its increase then bears to the content of the whole tree, is diminished one-half.

It may not be unuseful to observe, that the rate per cent. of increase in the last columns, is the same as the rate per cent. that the increase of the tree that year will pay for the money it was worth the preceding year.

In the two preceding tables, we find that the rate of increase per cent. per annum is the same in both at the same ages, although the quantity of timber in the second table is six times as much as in the first table in trees of all ages; therefore, when the age of a tree is known, the rate per cent. per annum of its increase is known on inspecting these tables, whether the tree has grown fast or slow; provided the growth of the tree has been regular, and that it has continued its usual growth.

And having the age, girt, and height of any tree given, we can readily calculate what quantity of timber it will contain at any future period whilst it continues its usual rate of growth.

A Table *showing the Number of Trees to be cut out in thinning of Woods, and the Number left standing at every Period of* 4 *Years from* 20 *up to* 64 *Years.*

In the 24th Volume of the Transactions of the Society of Arts, &c page 75, Mr. Salmon, in a paper on the Management of Fir Woods, says, " the distance of trees from each other should be one-fifth of their height." At that distance, which is probably sufficient for fir trees, the following will be the number on an acre, and the number to be cut out at the ages and heights under-mentioned, and the number of feet they will then contain in the bole, when measured to the top of the leading shoot. These trees are supposed to increase twelve inches in height, and one in circumference annually, and to have been at first planted four feet apart.

TABLE III.

Years old and feet high.	Girt.	Contents.			Distance.	Number of Trees on an Acre.	Contents of the whole.	Number to be cut out.	Contents
	inch.	ft.	in	pts.	feet.		feet.		feet.
20	2½	0	10	5	4·	2722	2362	839	727
24	3	1	6	0	4 8	1883	2824	494	741
28	3½	2	4	7	5·6	1389	3308	326	776
32	4	3	6	8	6·4	1063	3779	223	792
36	4½	5	0	9	7·2	840	4252	160	810
40	5	6	11	4	8·	680	4722	118	819
44	5½	9	2	11	8 8	562	5194	90	831
48	6	12	0	0	9 6	472	5664	70	840
52	6½	15	3	0	10·4	402	6130	55	838
56	7	19	0	8	11·2	347	6611	45	857
60	7½	23	5	2	12·	302	7076	37	866
64	8	28	5	4	12·8	265	7537		

And if trees be periodically thinned out to the distance of one-fifth of their height, and that they increase fifteen inches in height, and one inch and a half in circumference annually, the number of trees on an acre, and the number to be cut out at different periods, and the number of feet they will respectively contain at those periods, will be as under, viz.

TABLE IV.

Age.	Hght.	Girt.	Contents.			Distance.	Number of trees on an acre.	Contents of the whole.	Number to be cut out	Contents
years.	feet.	inch.	ft.	in.	pts.	feet.		feet.		feet.
16	20	3	1	3	0	4	2722	3402	980	1225
20	25	3¾	2	5	3	5	1742	4246	532	1290
24	30	4½	4	2	7	6	1210	5100	322	1357
28	35	5¼	6	8	4	7	888	5944	208	1392
32	40	6	10	0	0	8	680	6800	143	1430
36	45	6¾	14	2	10	9	537	7644	102	1452
40	50	7½	19	6	4	10	435	8494	75	1464
44	55	8¼	25	11	10	11	360	9355	58	1507
48	60	9	33	9	0	12	302	10192	45	1518
52	65	9¾	42	10	10	13	257	11026	35	1501
56	70	10½	53	7	0	14	222	11895	29	1553
60	75	11¼	65	10	11	15	193	12720	23	1515
64	80	12	80	0	0	16	170	13600		

It will be observed in all these tables, that when trees have doubled their age, there are only one-fourth of the number remaining on an acre, in consequence of their distance being doubled; but as each tree will then have increased its contents eight-fold, therefore the number of feet on an acre must be then doubled. Above, at 64 years of age, there is exactly double the number of feet that there is at 32 years of age.

And if trees be periodically thinned out to the distance of one-fifth of their height, and that they increase eighteen inches in height, and two inches in circumference, annually, the number of trees on an acre, and the number to be cut out at different periods, and the number of feet they will then respectively contain, will be as under, viz.

TABLE V.

Age.	Hght.	Girt.	Contents.			Distance.	Number of trees on an acre.	Contents of the whole.	Number to be cut out.	Contents
years	feet.	inch.	ft.	in.	pt.	feet.		feet.		feet.
12	18	3	1	1	6	4·	2722	3062	839	943
16	24	4	2	8	0	4·8	1883	5021	673	1794
20	30	5	5	2	6	6·	1210	6302	370	1927
24	36	6	9	0	0	7·2	840	7560	223	2007
28	42	7	14	3	6	8·4	617	8817	145	2072
32	48	8	21	4	0	9 6	472	10069	99	2112
36	54	9	30	4	6	10·8	373	11314	71	2153
40	60	10	41	8	0	12·	302	12583	52	2166
44	66	11	55	5	6	13·2	250	13864	40	2218
48	72	12	72	0	0	14·4	210	15120	32	2304
52	78	13·	91	6	6	15 6	178	16294	24	2197
56	84	14	114	4	0	16·8	154	17607	20	2286
60	90	15	140	7	6	18·	134	18843	16	2250
64	96	16	170	8	0	19·2	118	20138		

But if the trees be first planted four feet apart, and be periodically thinned out to the distance of one-fourth of their height, and that they increase twelve inches in height, and one in circumference, annually, the number of trees on an acre, and the number to be cut out at the ages and heights under-mentioned, and the number of feet they will respectively contain in the bole, when measured to the top of the leading shoot, will be as under, viz.

TABLE VI.

Years old & feet high.	Girt.	Contents.			Distance	Number of trees on an acre.	Contents of the whole.	Number to be cut out.	Contents.
	inch.	ft.	in.	pt.	feet.		feet.		feet.
16	2	0	5	4	4	2722	1209	980	435
20	2½	0	10	5	5	1742	1512	532	461
24	3	1	6	0	6	1210	1815	322	483
28	3½	2	4	7	7	888	2115	208	495
32	4	3	6	8	8	680	2417	143	508
36	4½	5	0	9	9	537	2718	102	516
40	5	6	11	4	10	435	3020	75	520
44	5½	9	2	11	11	360	3327	58	536
48	6	12	0	0	12	302	3624	45	540
52	6½	15	3	0	13	257	3919	35	533
56	7	19	0	8	14	222	4230	29	551
60	7½	23	5	2	15	193	4522	23	538
64	8	28	5	4	16	170	4835	20	568
68	8½	34	1	4	17	150	5116	16	545
72	9	40	6	0	18	134	5427	14	567
76	9½	47	7	6	19	120	5715	12	571
80	10	55	6	8	20	108	6000	10	555
84	10½	64	3	8	21	98	6301	8	554
88	11	73	11	4	22	90	6655	8	591
92	11½	84	5	11	23	82	6928	7	591
96	12	96	0	0	24	75	7200	6	576
100	12½	108	6	0	25	69	7486	5	542
104	13	122	0	8	26	64	7811	5	610
108	13½	136	8	3	27	59	8037	4	546
112	14	152	5	4	28	55	8384	4	609
116	14½	169	4	5	29	51	8659	3	508
120	15	187	6	0	30	48	9000	3	562
124	15½	206	10	7	31	45	9309	3	620
128	16	227	6	8	32	42	9557	2	455
132	16½	249	6	8	33	40	9982		

And if the trees be periodically thinned out to the distance of one-fourth of their height, and that they increase 15 inches in height, and one inch and a half in circumference annually, the number of trees on an acre, and the number to be cut out at the different periods under-mentioned, and the number of feet they will respectively contain at those periods, will be as under, viz.

TABLE VII.

Age.	Height.	Girt.	Contents.			Distance	Number of trees on an acre.	Contents of the whole.	Number to be cut out.	Contents.
Years.	feet.	inch.	feet.	in.	pts.	feet.		feet.		feet.
12	15	2¼	0	6	3	4·	2722	1417	980	510
16	20	3	1	3	0	5·	1742	2177	627	783
20	25	3¾	2	5	3	6·25	1115	2717	341	831
24	30	4½	4	2	7	7·5	774	3262	206	868
28	35	5¼	6	8	4	8·75	568	3802	133	890
32	40	6	10	0	0	10·	435	4350	91	910
36	45	6¾	14	2	10	11·25	344	4897	66	938
40	50	7½	19	6	4	12·5	278	5428	48	937
44	55	8¼	25	11	10	13·75	230	5976	37	962
48	60	9	33	9	0	15·	193	6513	29	978
52	65	9¾	42	10	10	16·25	164	7036	22	943
56	70	10½	53	7	0	17·5	142	7608	19	1018
60	75	11¼	65	10	11	18·75	123	8106	15	988
64	80	12	80	0	0	20·	108	8640		

And if the trees be planted at 4½ feet apart, and be periodically thinned out to the distance of one-fourth of their height; and that they increase 18 inches in height and 2 inches in circumference annually, the number of trees on an acre, and the number to be cut out at the different periods under-mentioned, and the number of feet they will then respectively contain, will be as under, viz.

TABLE VIII.

Age.	Height.	Girt.	Contents.			Distance	Number of trees on an acre.	Contents of the whole.	Number to be cut out.	Contents.
Years.	feet.	inch.	feet.	in.	pts.	feet.		feet.		feet.
12	18	3	1	1	6	4·5	2151	2419	941	1058
16	24	4	2	8	0	6·	1210	3226	436	1162
20	30	5	5	2	6	7·5	774	4031	237	1234
24	36	6	9	0	0	9·	537	4833	142	1278
28	42	7	14	3	6	10·5	395·	5645	93	1329
32	48	8	21	4	0	12·	302	6442	63	1344
36	54	9	30	4	0	13·5	239	7249	46	1395
40	60	10	41	8	0	15·	193	8041	33	1375
44	66	11	55	5	6	16·5	160	8873	26	1441
48	72	12	72	0	0	18·	134	9648	20	1441
52	78	13	91	6	6	19·5	114	10435	16	1464
56	84	14	114	4	0	21·	98	11204	12	1372
60	90	15	140	7	6	22·5	86	12093	11	1546
64	96	16	170	8	0	24·	75	12800	—	

It is difficult in thinning plantations to leave the trees at nearly equal distances. The distances stated in all these tables must be considered the average distances. If, for instance, there be 302 trees on an acre, their average distance will be 12 feet, although few of them may stand at exactly that distance.

If the trees be first planted 4 feet apart, and be periodically thinned out to the distance of one-fourth of their height until they are 28 feet high, and to one-third of their height afterwards, and that they increase 12 inches in height and one in circumference annually, the number of trees on an acre, and the number to be cut out at the ages and heights under-mentioned, and the number of feet they will then respectively contain in the bole, when measured to the top of the leading shoot, will be as under, viz.

TABLE IX.

Years old and feet high.	Girt.	Contents.			Distance	Number of trees on an acre.	Contents of the whole.	Number to be cut out.	Contents.
	inches.	feet.	in.	pts.	feet.		feet.		feet.
16	2	0	5	4	4	2722	1209	980	435
20	2½	0	10	5	5	1742	1512	532	461
24	3	1	6	0	6	1210	1815	322	483
28	3½	2	4	7	7	888	2115	453	1078
30	3¾	2	11	1	10	435	1271	133	388
36	4½	5	0	9	12	302	1528	80	404
42	5¼	8	0	5	14	222	1783	52	417
48	6	12	0	0	16	170	2040	36	432
54	6¾	17	1	0	18	134	2289	26	444
60	7½	23	5	2	20	108	2530	18	421
66	8¼	31	2	4	22	90	2807		

Observations on Table IX.

On examining several oak woods, it appeared to me, that the distance of one-third of their height was not too much where the trees were from 30 to 40 feet high and upwards.

I have therefore calculated a table according to the distance of one-fourth of their height, till they are 28 feet high, and according to the distance of one-third of their height afterwards.

The timber to be thinned out before the age of 28 years, will be the same as in Table VI. but at 28 years of age there are 583 feet more to be cut out according to this Table than at the same age in Table VI.; there will however be less to be cut out between the ages of 28 and 60 years of age. But if the trees in this Table, in consequence of having more room, were to increase 1¼ inch in circumference annually, instead of 1 inch after they are 28 years of age, the produce of an acre at 60 years of age would equal the produce stated in Table VI. at the same age; taking into consideration that the value of the 583 feet excess cut out at 28 years of age would then be more than quadrupled, if the money were placed out at 5 per cent. compound interest. A considerable additional increase in circumference may certainly be expected, in consequence of the trees having almost double the room in which to extend their branches, and for the admission of those powerful agents, sunshine and air.

Observations on the Tables respecting the Thinning of Woods, and their Produce.

Mr. Salmon is the only person I know of, who has given a general rule for thinning plantations. But as I conceive his distance of one-fifth of their height would leave oaks too close, especially after they had acquired a sufficient length of stem, I have calculated both on his plan, which is proper for fir trees, and also at greater distances.

The preceding Tables VI. VII. and VIII. are calculated on a supposition that the trees are never suffered to stand nearer, on an average, than one-fourth of their height; and although the quantities of timber thinned out and left standing on the ground at that distance, at the end of 60 years, be only two-thirds of the quantity according to Mr. Salmon's distance, yet I suppose it will be generally thought an ample produce and sufficiently encouraging.

According to Table VI. which is calculated for oaks, the first thinning is at sixteen years old, and the second at twenty, but it is the advice of an eminent planter, (Mr. Pontey,) to begin thinning at about thirteen years old, according to the state of the trees, and to cut out about 150 poles per acre annually, for the next seven years. Without putting any value upon the thinnings before 20 years old, we find that at the 20th and 24th years, the thinnings measure 945 feet, the value of which, at a low estimate, will be sufficient to repay the rent and taxes, of ground of a moderate quality, the expense of plants, planting, and after-management, calculated at 5 per cent. compound interest.

When 28 years old, and at the end of every fourth year following, up to 120, the trees to be cut out of an acre will measure from 495 to 550 feet; but say 500, at 4*s.* a foot, on an average, including the value of the bark; this gives 100*l.* which sum divided by 4, leaves 25*l.* for the produce per acre per annum. This deserves the consideration of those who are inclined to convert young woods into coppices, without leaving a reasonable number of standards.

It may however be said, that as the trees cut out in thinning plantations are the bad thrivers and underlings, their contents will be less than the average; but, if we take their value at one-half the above estimate, that is, after the rate of 12*l.* 10*s.* per acre per annum at 28 years of age and upwards, even this produce must be thought ample, together with the value of the trees left standing.

Table VI. was constructed chiefly with a view to oaks, their annual increase in circumference varying from ¾ of an inch to 1¼ inch, the medium of which is 1 inch.

Tables VII. and VIII. were calculated for ash, elm, sycamore, firs, poplars, and other woods of swift growth, their increase in circumference being generally from 1½ to 2 inches annually. If ash trees be found to increase after the rates of Table VII. or VIII. they must be exceedingly profitable, at the high prices now given for that timber. Many other observations might be made on Tables VII. and VIII. but these will readily occur to persons interested in quick growing trees.

An acre of trees increasing after the rate of Table VI. produces in 64 years little more than half the number of feet that another acre produces which increases after the rate of Table VII. and little more than one-third of another, increasing after the rate of Table VIII. in the same time.

In planting with a view to profit, the first object is a long, straight, and clear stem. This is most certainly and speedily obtained by thick planting at first, and not thinning too soon. A kind of competition among the trees is thereby occasioned, each struggling, as it were, to outgrow its neighbour, in search of light, heat, air, and moisture.

This competition must, however, be judiciously moderated by timely thinning; always keeping the trees sufficiently strong in the stem. If they be suffered to stand some years too near each other, their stems will become weak, and bend under their small tops when thinned.

Where this has taken place in only a small degree, they will make but little progress for some years afterwards.

By the time the trees have advanced to 24 or 30 feet high this competition should cease, if they are intended to be cut down at or before 60 years of age, and they should then be encouraged to extend their tops more in width than in height, strong side branches being apparently quite as conducive as the leading shoot, to the vigorous growth of the bole below them. After this period, the best rule for thinning will probably be, to leave a clear space around the top of each tree, in which the branches may extend themselves without obstruction. A tree whose top is 20 feet diameter, receives four times the benefit from air, rain and dew as another does whose top is only 10 feet diameter.

The trees in the interior of young woods are smaller in their boles than the exterior trees. And in a fine oak wood, of about 40 acres, divided into squares by several avenues or ridings crossing each other at right angles, I observed the rows of trees next the avenues much thicker in their boles than the trees in the interior of the squares; owing, no doubt, to their having more and larger branches in consequence of their having more room, although it is only on one side.

Being too parsimonious of ground seems to me a great and very general error. If the same number of trees of 32 feet high and upwards, in Table VI. were allowed the space of two acres instead of one, and, in consequence of their standing thinner, were to increase annually only the fiftieth part of an inch more in girt than they would do if they stood on one acre, this small additional increase in girt would pay an ample rent for the additional acre.

In the year 1791 a paper of Observations on the Propagation and Management of Oak Trees in general, but more particularly applying to his Majesty's New Forest in Hampshire, was published by T. Nichols, Purveyor of the Navy for Portsmouth Dock-yard.

In this paper it is said, that "there are to be seen in many parts of the forest from 40 to 50 fine oaks standing on an acre that will measure one with another two loads a tree."

"Several woods in the forest are almost ruined for want of thinning, and its being done at proper times; particularly the inclosures that were made in the year 1700; —these were originally well planted, and great numbers of trees brought up in them, which now remain so close together that they are nearly stagnated, particularly in Salisbury, Trench, Brimley Coppice, and Woodfidley; and, although it is 90 years since they were planted, the trees will not measure, one with another, above six or seven feet a tree; whereas, if the business of thinning had been done as it ought, the remaining trees (after drawing much useful timber) would by this time have been of a size nearly fit for naval uses, as in some of the woods that were planted at the same time, the trees which have had room to expand, and a free air admitted to them, will measure from 70 to 80 feet."

Observations on the Growth of Timber.

The rings observable in the transverse section of a tree at its but-end, are the same in number as the years of its age; an additional ring being produced annually, in consequence of the annual rising of the sap. The rings are nearly concentric in trees that have grown in the interior of close shady woods, but eccentric in others, being of different breadths on the northern and southern sides of such as have grown single, or in any other situation where their boles have been much exposed to the rays of the sun. This difference is occasioned by the different degrees of heat to which the opposite sides of the boles of trees are exposed. And, indeed, we find these rings are always broadest on that side of the bole or stem most warmed by the sun. Hence we see the utility of exposing their boles as much as possible to its rays*. It is often seen in the stumps of trees that have stood single, that they have grown nearly twice as fast on the southern side as on the northern, their pith being so much nearer to the northern side.

It is, however, to be remarked, that the wood from that side of a tree which has grown the slowest, is heavier than from the opposite side which has grown the fastest, and it is probably stronger in the same degree.

It may be worth the consideration of those who have southern hangs or declivities to plant, whether to plant, or rather leave the trees in thinning, in double rows in lines running east and west, at about fourteen or sixteen feet distance, and the double rows at about thirty-six feet distance, less or more, according as the declivity is more or less, in order that their boles may receive the greatest possible benefit from the direct rays of the sun.

No doubt many gentlemen are in possession of facts that would in some degree ascertain how much faster the boles of trees swell that stand exposed to receive the full benefit of the warmth of the sun, than those that are either partially or constantly in the shade. To make these facts known would materially benefit planters; for I am fully persuaded that there are but few persons apprised of the magnitude of the power of the sun's rays upon the boles of trees in causing them to swell.

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* On a hot day in the middle of May I have observed the mercury in the thermometer to rise and fall from twelve to sixteen degrees, on hanging it alternately on the sunny and shady sides of the same tree, between the hours of two and five o'clock, at which time of the day the heat is generally the greatest.

Of the most profitable Length of Boles of Trees.

We rarely see timber trees pruned, and still more rarely do we see the pruning performed in a judicious manner. This business should commence early, never suffering the branches on the intended stem or bole to grow to a large size, in order that, when cut off, the wounds may be small and soon healed. Those who want directions for performing the operation, may think it well to consult Mr. Pontey's Forest Pruner. There are, however, divers opinions as to the most profitable height to which trees ought to be pruned, and the instruments most proper for pruning; some persons objecting to the use of the saw, unless afterwards smoothed by the knife; and not a few objecting to pruning in any way, the consequence of which is, that we often find trees that stand single, particularly oaks, with boles not more than six or eight feet high, but with wide spreading bushy tops, fit only for the fire. The shade and drip of one such tree is sometimes found to do more injury than four well-trained trees, and perhaps it is not of half the value of one of them. On the contrary, trees in close plantations are often suffered to stand so much too thick as to destroy each other's branches, excepting only a few small ones near their tops; and not unfrequently we see tall elms trimmed up to within a few feet of their summits—it is certain that such trees must swell very slowy in their boles; for we find in woods where the trees are all of the same age, that those with the largest tops have generally the thickest boles.

There is no doubt a medium length of bole for different kinds of trees on different soils, that will be found productive of more timber, or timber of more value, than boles that are much longer or much shorter. And although we may not be able previously to decide with certainty what that exact length of bole is, in any kind of trees, on any soil, which will eventually prove most profitable, yet it is deserving of investigation, if we can thereby approach with certainty to within a few feet of the exact point. It is certainly a matter of too much importance to be left, as it generally is, to each individual woodman to decide upon, according to his own vague opinion. I shall, therefore, take the liberty of stating by what steps I have endeavoured to approximate towards the most profitable lengths of boles of trees of different rates of growth, that are not intended to stand beyond the age of sixty years.

In the preceding tables the trees are supposed to be measured to the top of the leading shoot, but in the following tables only to the height of their boles of 24, 32, and 40 feet.

TABLES *showing the Increase of* BOLES *of* TREES *of different Lengths.*

If a tree has increased twelve inches in height and one in circumference annually, until it is twenty-four years old, it will then be twenty-four feet high, and three inches girt at twelve feet high; and supposing that in process of time this tree be pruned up so as to leave the bole twenty-four feet high clear of branches, and that it continue increasing one inch in circumference annually, the rate per cent. per annum of its increase will be as under, exclusive of the increase of timber in its top and lateral branches.

TABLE X.

Years old.	Girt.	Contents.			Years old.	Girt.	Contents.			One year's increase.			Increase per cent. per annum.
	in.	ft.	in.	p.		in.	ft.	in.	p.	ft.	in.	p.	
24	3	1	6	0	25	3¼	1	9	1	0	3	1	17·1
28	4	2	8	0	29	4¼	3	0	1	0	4	1	12·7
32	5	4	2	0	33	5¼	4	7	1	0	5	1	10·1
36	6	6	0	0	37	6¼	6	6	1	0	6	1	8·4
40	7	8	2	0	41	7¼	8	9	1	0	7	1	7·2
44	8	10	8	0	45	8¼	11	4	1	0	8	1	6·3
48	9	13	6	0	49	9¼	14	3	1	0	9	1	5·6
52	10	16	8	0	53	10¼	17	6	1	0	10	1	5·04
56	11	20	2	0	57	11¼	21	1	1	0	11	1	4·5
60	12	24	0	0	61	12¼	25	0	1	1	0	1	4·1
64	13	28	2	0	65	13¼	29	3	1	1	1	1	3·8
68	14	32	8	0	69	14¼	33	10	1	1	2	1	3·5
72	15	37	6	0	73	15¼	38	9	1	1	3	1	3·3
76	16	42	8	0	77	16¼	44	0	1	1	4	1	3·1
80	17	48	2	0	81	17¼	49	7	1	1	5	1	2·9
84	18	54	0	0	85	18¼	55	6	1	1	6	1	2·7
88	19	60	2	0	89	19¼	61	9	1	1	7	1	2·6
92	20	66	8	0	93	20¼	68	4	1	1	8	1	2·5
96	21	73	6	0	97	21¼	75	3	1	1	9	1	2·3
100	22	80	8	0	101	22¼	82	6	1	1	10	1	2·2
120	27	121	6	0	121	27¼	123	9	1	2	3	1	1·8
140	32	170	8	0	141	32¼	173	4	1	2	8	1	1·5
160	37	228	2	0	161	37¼	231	3	1	3	1	1	1·3

But if a tree increase 12 inches in height and one inch in circumference annually, until it be 32 feet high, and in process of time the bole be pruned up to that height, the rate per cent. per annum of the increase of this bole will be as under, exclusive of the increase in its top and lateral branches.

TABLE XI.

Years old.	Girt.	Contents.			Years old.	Girt.	Contents.			One year's increase.			Increase per cent. per ann.
	inch.	ft.	in.	pts.		inch.	ft.	in.	pts.	ft.	in.	pts.	
32	4	3	6	8	33	4¼	4	0	2	0	5	6	12·9
36	5	5	6	8	37	5¼	6	1	6	0	6	10	10·25
40	6	8	0	0	41	6¼	8	8	2	0	8	2	8·5
44	7	10	10	8	45	7¼	11	8	2	0	9	6	7·3
48	8	14	2	8	49	8¼	15	1	6	0	10	10	6 3
42	9	18	0	0	53	9¼	19	0	2	1	0	2	5·6
56	10	22	2	8	57	10¼	23	4	2	1	1	6	5·06
60	11	26	10	8	61	11¼	28	1	6	1	2	10	4·59
64	12	32	0	0	65	12¼	33	4	2	1	4	2	4·2
68	13	37	6	8	69	13¼	39	0	2	1	5	6	3·88
72	14	43	6	8	73	14¼	45	1	6	1	6	10	3·6
76	15	50	0	0	77	15¼	51	8	2	1	8	2	3·36
80	16	55	10	8	81	16¼	58	8	2	1	9	6	3·1
100	21	98	0	0	101	21¼	100	4	2	2	4	2	2·39
120	26	150	2	8	121	26¼	153	1	5	2	10	9	1·92

But if a tree increase 12 inches in height and one inch in circumference annually, until it be 40 feet high, and in process of time the bole be pruned up to that height, the rate per cent. per annum of the increase of this bole will be as under, exclusive of the increase in its top and lateral branches.

TABLE XII.

Years old.	Girt.	Contents.			Years old.	Girt.	Contents.			One year's increase.			Increase per cent. per ann.
	inch.	ft.	in.	pts.		inch.	ft.	in.	pts.	ft.	in.	pts.	
40	5	6	11	4	41	5¼	7	7	10	0	8	6	10·2
44	6	10	0	0	45	6¼	10	10	2	0	10	2	8·47
48	7	13	7	4	49	7¼	14	7	2	0	11	10	7·2
52	8	17	9	4	53	8¼	18	10	10	1	1	6	6·3
56	9	22	6	0	57	9¼	23	9	2	1	3	2	5·6
60	10	27	9	4	61	10¼	29	2	2	1	4	10	5·05
64	11	33	7	4	65	11¼	35	1	10	1	6	6	4·58
68	12	40	0	0	69	12¼	41	8	2	1	8	2	4·2
72	13	46	11	4	73	13¼	48	9	2	1	9	10	3·87
76	14	54	5	4	77	14¼	56	4	10	1	11	6	3·59
80	15	62	6	0	81	15¼	64	7	2	2	1	2	3·35
100	20	111	1	4	101	20¼	113	10	10	2	9	6	2·51
120	25	173	7	4	121	25¼	177	1	2	3	5	10	2·00

Observations respecting Trees of different Lengths in the Bole.

Trees that increase annually 12 inches in height and one in circumference, and have boles of different lengths, these boles, if of the under-mentioned lengths, increase after the rate of 5 per cent. per annum at the ages and heights under-mentioned, and they measure as under, viz.

									Contents.		
			Year's old.		In.		Ft.		Ft.	in.	p.
Trees with	12	feet boles at	46	their girt	10	at	6	high,	8	4	0
Do.	16	do.	48	do.	10	at	8	do.	11	1	4
Do.	24	do.	52	do.	10	at	12	do.	16	8	0
Do.	32	do.	56	do.	10	at	16	do.	22	2	8
Do.	40	do.	60	do.	10	at	20	do.	27	9	4
Do.	48	do.	64	do.	10	at	24	do.	32	4	0

Whatever the lengths of the boles of trees increasing as above may be, the increase is 5 per cent. per annum one year after their girt in the middle is 10 inches, but not longer.

But supposing that these trees have grown to 60 years of age, and increased as above-mentioned, their girt and contents at that age would be as under, viz.

							Contents.		
							F.	i.	p.
Trees with	16	feet boles,	13	inches girt at	8	feet high,	18	9	4
Do.	20	do.	12½	do.	10	do.	21	8	5
Do.	24	do.	12	do.	12	do.	24	0	4
Do.	32	do.	11	do.	16	do.	26	10	8
Do.	40	do.	10	do.	20	do.	27	9	4

This table shows that the advantage to be gained by pruning trees higher than 32 feet, is not an object worthy of consideration, if the trees are to be cut down at the age of 60 years.

And if it should be found that the higher a tree is pruned, the slower it swells in the bole, perhaps a 24 feet bole may measure as much at 60 years old as a 32 feet bole. If it increases half an inch in girt in the last 36 years more than the 32 feet bole increases in the same time, it will very nearly equal it in measure.

A 32 feet bole with a top from 20 to 30 feet high, with many large lateral branches, is certainly a much finer object than a forty feet bole with a top only twenty feet high, with few and small lateral branches: and at sixty years old, the former will have had to increase in the last twenty-eight years, only one quarter of an inch in girt, more than the latter, to exceed it in measure, to say nothing of the excess of timber in the larger top and branches. It must, however, be remarked, that at eighty years of age, the forty feet bole will exceed the thirty-two feet bole nearly six feet; and at one hundred years, thirteen feet, provided it swell equally fast in thickness. But unless the trees be oak, fit for the use of the navy, for which an increased price can be had, I imagine few gentlemen would now choose to let their trees stand to eighty years of age, when the increase of their boles will not be four per cent.; still fewer would let them stand to one hundred, when the increase will not be three per cent. per annum.

Again, let it be supposed that trees sixty years of age have increased annually, during their growth, fifteen inches in height, and one inch and a half in circumference, the girt and contents of their boles, if of the under-mentioned lengths, will be as under, viz.

							Contents.		
							F.	i.	p.
Trees with	20	feet boles, will be	19½	inches girt at	10	feet high,	52	9	9
Do.	25	do.	18¾	do.	12½	do.	61	0	5
Do.	30	do.	18	do.	15	do.	67	6	0
Do.	40	do.	16½	do.	20	do.	75	7	6
Do.	50	do.	15	do.	25	do.	78	1	6

Taking it for granted that the shorter boles will increase faster in thickness than the longer ones, it is reasonable to expect that the forty feet bole will contain more timber than the fifty feet bole when they are both sixty years old; and if they are both sold at the same rate per foot, the forty feet bole must consequently be more valuable. If, however, a higher price can be had for longer boles, this may compensate not only for their deficiency in measure at sixty years of age, but also for their standing beyond the period when they cease paying the common rate of interest for the money they are worth, which I suppose is frequently the case as to tall elm trees, fit for keel pieces, and perhaps beech for ship planking. It is hence evident, that where the soil is such as will enable trees to grow to a great height, it will be necessary, before we decide how high to prune them, to consider to what purposes the timber can be most advantageously appropriated.

Whatever the lengths of the boles of trees increasing as above may be, their increase is five per cent. per annum, one year after their girt in the middle is 15 inches, but not longer.

Again, let it be supposed that trees sixty years of age have increased annually, during their growth, eighteen inches in height, and two inches in circumference, the girt and contents of their boles, if of the under-mentioned lengths, will be as under, viz.

							Contents.		
							F.	i.	p.
Trees with	24	feet boles, will be	26	inches girt at	12	feet high,	112	8	0
Do.	30	do.	25	do.	15	do.	130	2	6
Do.	36	do.	24	do.	18	do.	144	0	0
Do.	48	do.	22	do.	24	do.	161	4	0
Do.	60	do.	20	do.	30	do.	166	8	0

Here again we may suppose that the forty-eight feet bole, by swelling faster than the sixty feet bole, may exceed it in measure at sixty years of age, and this it would do, were the girt increased only half an inch. And if the thirty-six feet bole was increased two inches in girt, it would exceed both the forty-eight and sixty feet boles. But trees of such swift growth are frequently cut down before they are sixty years old. At forty years of age the thirty-six feet bole, if it swell no faster than the forty-eight feet bole, will contain more timber if measured according to the present erroneous method. (The greater disproportion there is between the two ends of a piece of timber, and the more disadvantageously it measures, when the girt is taken in the middle.) I suppose that in timber of this swift growth, the longer boles are frequently not worth more per foot than the shorter boles; therefore, in this case, that length of bole should be fixed on which is likely to measure most at the period when the trees are intended to be felled.

Whatever the lengths of the boles of trees increasing as above may be, their increase is five per cent. per annum, one year after their girt in the middle is 20 inches, but not longer.

It appears from the last observations and calculations, that the annual increase in the boles of trees by their growth, ceases to be equal to five per cent. per annum some time between forty-six and sixty years of age, according as the boles are shorter or longer.

But it being generally allowed that oak trees, of a size fit for the navy, require to grow from eighty to one hundred and fifty years, according to the quality of the soil, and it is so stated in the eleventh report of the commissioners appointed to inquire into the state and condition of the woods, forests, and land revenues of the crown; I have therefore been calculating tables, showing what the proportionably advanced prices should be, at different periods, up to one hundred and fifty years, to pay the proprietors for letting their trees stand to those periods. These prices, especially at the later periods, very greatly exceed any that have ever been given. It certainly has been much the interest of the growers of oak timber to fell it at about sixty years of age, even if they replant the same ground. To let it stand to one hundred and twenty years of age, and sell it at the present prices, their loss would exceed double the whole value of the timber at sixty years of age. Nothing short of a sufficient price will long command a sufficient supply. Owing to too low prices the quantity of large timber on private estates has long been rapidly decreasing; and it will be too late to commence offering reasonable prices for it when it is all gone, and no oaks left of greater growth than sixty years. To have to wait their growing the second sixty years, may bring upon us evils exceeding all calculation.

Valuations made in October, 1807, *of several Plantations in Staffordshire.*

The valuations were made of the trees growing within the space of a chain square, being the tenth part of an acre, of the medium growth of each plantation.

In the plantation by the mill wall there are now growing within twenty-two yards square, as under, viz.

	£.	*s.*	*d.*		*£.*	*s.*	*d.*
70 oak trees, containing 175 feet, at 2*s.* 3*d.*	19	13	9				
1200 of oak bark, at 12*s.*	7	4	0				
	26	17	9	or, per acre,	268	17	6

The above is part of about four acres planted in 1775, on a strong loamy soil, worth about 20*s.* an acre.

	£.	s.	d.
One pound per ann. forborn 32 years, and improved at 5 per cent. compound interest, would amount to	75	6	0

But the value of the timber is more than three times this amount.

The ground was prepared for planting by ploughing.

On the east side of Cottage Wood there are now growing, within twenty-two yards square, as under, viz.

	£.	s.	d.		£.	s.	d.
50 ashes, containing 300 feet, at 1*s.* 6*d.*	22	10	0				
13 oaks do. 7 do. 2*s.*	0	14	0				
Bark	0	7	0				
	23	11	0	or, per acre,	235	10	0

The above is part of about two acres planted in 1776, partly on heaps of earth in clay pits, and partly on strong soil upon a deep bed of sand, value about 15*s.* an acre.

	£.	s.	d.
Fifteen shillings per annum, forborn 31 years, and improved at 5 per cent. compound interest, would amount to	53	0	0

But the value of the timber is more than four times this amount.

In the clay pits only holes were dug for the plants, but the other part wholly trenched, or double dug with the spade.

In Pickmore Pool Plantation there are now growing, within twenty-two yards square, as under, viz.

	£.	s.	d.		£.	s.	a.
97 Scotch firs, containing 636 feet*, at 1*s.* . . .	31	16	0	or, per acre,	318	0	0

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* This produce is after the rate of 6360 feet an acre, which is about the rate of Table IV.

The last plantation is part of about six acres planted in the springs of 1778 and 9. Much of the soil is a tough peat on gravel or hungry white sand, worth, say 5*s.* per acre.

This ground laid between two tenants who had never cultivated it. They had then nineteen years unexpired of their lease of thirty-one years of this and the adjoining lands, and willingly gave it up to be planted, on condition of having the fences made and kept in good repair.

	£.	*s.*	*d.*
Five shillings a year, forborn 29 years, and improved at 5 per cent. compound interest, would amount to	15	11	0

But the value of the timber is more than twenty times this amount.

The trees were about two feet high, and planted at two yards distance, in holes dug with the spade, 1210 on an acre. Labour of making the holes and planting the trees cost 1*l.* 6*s.* 10½*d.* per acre.

About 2700 were planted on an acre in the other plantations, where the ground was wholly broken up.

In the remarks on these three plantations, no notice is taken of the thinnings. I am informed by gentlemen who have kept accounts of thinnings, that these have repaid the rent of the land and every expense, with compound interest, some time before the woods were thirty years old; and the preceding calculations show that it may be so. And if so, the present value of these plantations is all clear gain.

The valuer of these plantations has bought a good deal of wood out of them; and the prices he has valued at per foot, may possibly be a fair value there for such small timber.

The growth of the firs in the last-mentioned plantation, is probably as great in that poor ground as it would have been had they been planted on ground of three or four times its value; this must be a powerful inducement to gentlemen to plant all such poor ground in the first instance.

And a few of oaks, ashes, and firs, may be raised on almost every farm in screens, that may, by their shelter, increase the value of the farm to the occupier, by increasing the produce, particularly that of grass grounds. In this case the interest of landlord and tenant may be reciprocal; but it is the reverse where trees are planted in hedge-rows.

And even the sides and tops of high mountains may be made abundantly more productive of grass, if certain portions of them were surrounded by plantations. These plantations, by breaking the force of cold winds, diminish their chilling effect on the fields the plantations surround, and render the climate on mountains much more mild and genial.

This last kind of improvement will generally be found very greatly to exceed the expectation of the improver, provided it be judiciously planned and executed.

May I take the liberty to suggest, that information of very great value might be obtained by the Society from the gentlemen to whom medals and premiums have been given for planting trees, if they would favour the Society with their subsequent observations respecting those plantations.

It would, for instance, be desireable to have the nature of the soil and under strata described,—the sorts of trees best suited thereto,—the distance at which the trees were first planted,—at what periods they were thinned, and how many cut out at each thinning, and their measure and value,—the present height, distance, measure, and value, of the trees now growing on an acre—what distances are found most advantageous, and also the best height to be pruned.

The fund of information that such communications might afford, would prove of very great value indeed to future planters, as well as to many proprietors of plantations of different ages now growing.

If the Society should think it adviseable to solicit this information, no doubt the ample and valuable materials they would thereby obtain, would enable some abler pen to do justice to the curious and important subjects of the preceding pages. In the mean time it is hoped, that this attempt to reduce our knowledge of the growth of timber to something like system, however imperfect it may be, will be received with indulgence. Assuredly, it had not so soon seen the light, had not the present situation of our country imperiously demanded of every individual his utmost exertion to render us as independent as possible of supplies of every kind from the continent of Europe, from which we are now almost totally excluded.

C. WAISTELL.

High Holborn, March 15, 1808.

To CHARLES TAYLOR, M. D. SEC.

The GOLD MEDAL *of the Society was this Session voted to* JOHN CHRISTIAN CURWEN, *Esq. M. P. of Workington-Hall, Cumberland, for his Improvements in the* CULTURE OF VEGETABLES. *The following Communications were received from him.*

SIR,

I AM fearful you should suppose that I am become indolent, and that the favours so liberally bestowed on me by the Society, had ceased to operate as a stimulus to the further exertions of my humble endeavours to assist those objects which, by the fostering hand of the Society, have been so essentially promoted. You will excuse me for wishing to assure you that I am not idle, and to inform you that the objects which at present employ me are, I conceive, of great importance to agriculture.

The first is by experiments to ascertain the best and most productive mode of applying manure. The second is to determine whether the distances between the stitches in drill husbandry may not be greatly enlarged, without any diminution of crop.

I am strongly inclined to believe that where the ground is laid dry, that manure can scarcely be deposited too deep; by so doing the evaporation is retarded, and consequently the manure continues for a greater length of time to furnish nourishment to the crop.

The increase of the distances between the stitches, permits the power of continuing the operations of turning up the soil to a more extended period, which not only improves the tilth, but furnishes a greater degree of moisture by exhalation, than can be yielded from ground in that state of hardness it soon acquires when undisturbed in summer. This evaporation is prodigious, though not perceptible to the eye: it is, however, fully demonstrated by a very ingenious experiment of the Bishop of Llandaff; and I am anxiously expecting to form such conclusions from trials I am engaged in respecting its effects on vegetation, as may deserve the consideration of the Society.

My former objects of feeding cattle with potatoes, supplying milk to the poor, &c. are pursued with increased success. The use of potatoes as a food for horses and cattle increases daily.

I am, dear Sir,

Your faithful and obedient Servant,

J. C. CURWEN.

Ibbetson's Hotel,
London, April 21st, 1807.

To Charles Taylor, M. D. Sec.

Dear Sir,

It is with great satisfaction that I have the honor of again submitting the result of my farming operations to the consideration of the Society of Arts. Deeply impressed with a sense of the many favors conferred upon me by them, I have found myself impelled, both by gratitude and inclination, to proceed with redoubled exertion, as the best return in my power.

The liberal patronage and encouragement bestowed on agriculture by the Society, has powerfully contributed to awaken the country to a just estimation of its importance, as the basis of individual happiness and national prosperity; and at this moment the empire owes its preservation and security to it.

I submit with great deference the result of my recent operations. I am disposed to flatter myself that they may lead to important consequences and discoveries, highly beneficial to agriculture. The experiments I have made tend to establish the double advantage of well cleaning and working the ground. First, as it frees the land from weeds; and secondly, as it conduces to the growth of the crop. It affords likewise a very strong demonstration in favour of using manure in its freshest state, by which not only the great usual expense of making dunghills will be saved, but the manure made to extend to the improvement of a third more land.

Most of the farm I occupy was in that state of foulness as to require, according to general practice and opinion, a succession of fallows to clean it. Being unwilling to adopt a system which is attended with such loss, I determined to attempt to clean a part of it by green crops, and for such purpose to allow a much greater distance between the stitches than had ever been in practice. My first experiment on this plan was made on a crop of cabbages; they were planted in a quincunx form, allowing four feet and a half between each plant, in order to allow room for the plough to work in all directions. I adopted this plan of field husbandry, as affording the greatest facility in cleaning the crop, though I believe it never was before so practised. Two thousand three hundred and fifty plants were set per acre (eight thousand is not unusual in the common method), and each plant had, by computation, an allowance of a stone of manure, or less than fourteen tons per acre; though the common quantity is generally from thirty to forty tons per acre. The manure was deposited as deep as the plough could penetrate, drawn by four horses, and the plant set directly above it.

The plough and harrow constructed to work betwixt the rows, were constantly employed during the summer, and the ground was as completely freed from weeds as it could have been by a naked fallow. The very surprising weight of my crop, which in October was thirty-five tons and a half per acre, and many of the cabbages fifty-five pounds each, were matters of surprise to all who saw them, as well as to me, and I could assign no satisfactory reason for the fact. The quality of the land was very indifferent, being a poor cold clay,—the manure was very deficient of the usual quantity,—the plants when set by no means good,—in short there was nothing to justify the expectation of even a tolerable crop. I did not find any thing in the accounts from cultivators of cabbages to afford me a solution of my difficulties, or any clue to explain it. By mere accident I met with the Bishop of Landaff's experiment ascertaining the great evaporation from the earth, as related in his admirable Treatise on Chymistry; singular as it may appear, this very interesting experiment had remained for thirty years without any practical inferences being drawn from it applicable to agriculture. It appeared to me highly probable, that the rapid advance in growth made after the hoeing of drilled grain, was attributable to the absorption of the evaporation produced from the earth, and was the cause of the growth of my cabbages. With great impatience and anxiety, as I had the honour to inform you last year, I looked forward to the ensuing season to afford me an opportunity of continuing my experiments. I had long been a strenuous advocate for deep burying of manure, though my sentiments rested chiefly on opinion; this appeared to open a field for incontestible proofs of its advantage. My cabbages were last year planted on the same plan as the former year. Fortunately I extended the same principle to my potatoes, which I was obliged to set on wet strong ground, from want of a choice of land. My annual quantity of potatoe ground is from sixty to seventy acres. They were set in beds three feet long and two feet broad, leaving four feet and a half between each bed lengthways, and three feet endways. On each acre there were 1230 beds, and 6150 sets, or five to each bed, viz. one at each corner, and one in the middle. The sets of potatoes, when planted according to the usual most approved practice, in three feet stitches, and nine inches apart, amount to about twenty thousand. In the present, and indeed in all seasons when potatoes are scarce, the saving in planting is a considerable object. A great advantage also arises in being able to keep the potatoes and manure from wet. In the late uncommonly wet season I sustained little or no loss in my mode, which was not the case in many of the driest grounds. This plan unites hand hoeing with horse culture, and will be found serviceable in wet soils.

The lateness of planting, together with the premature frosts, prevented my forming a fair judgment as to the quantity per acre which might be obtained by this method. My view in fixing upon this plan was, to enable me to judge of the effects of evaporation, by being able to continue my operations for a longer period. I have no doubt but that in common seasons, notwithstanding the increased distance, the whole ground would be covered.

My experiments on cabbages this season commenced by planting them early in April. From the rain which fell subsequently, and continued till the beginning of May, succeeded by severe east winds, the earth became so hard and baked, that the plants had made very little progress.

In the first week in June the ploughs were set to work; as they started, Mr. Ponsonby of Hail Hall was present, and saw the crop; it was with difficulty that the ground was first broken, but by the end of the week it was brought into fine tilth. Notwithstanding the whole week had been dry, with a strong sun and severe east wind, yet such was the progress in growth of the cabbages, that when seen again by that gentleman on the Saturday, he could scarce be persuaded they were the same plants.

During these operations I had been making constant experiments with glasses, contrived for the purpose, to ascertain the quantity of evaporation from the land, which I found to amount, on the fresh ploughed ground, to nine hundred and fifty pounds per hour on the surface of a statute acre, whilst on the ground unbroken, though the glass stood repeatedly for two hours at a time, there was not the least cloud upon it, which proved that no moisture then arose from the earth.

The evaporation from the ploughed land was found to decrease rapidly after the first and second day, and ceased after five or six days, depending on the wind and sun. These experiments were carried on for many months. After July the evaporation decreased, which proves that though the heat of the atmosphere be equal, the air is not so dense. The evaporation, after the most abundant rains, was not advanced beyond what the earth afforded on being fresh turned up. The rapid growth of my potatoes corresponded perfectly with the previous experiments; and their growth in dry weather visibly exceeded that of other crops where the earth was not stirred. The component parts of the matter evaporated remain yet to be ascertained; the beneficial effects arising from it to vegetation cannot be doubted or denied, but whether they proceed from one or more causes, is a question of much curiosity and importance.

May not a similar process here take place, as when water is exposed to the action of the air in irrigation? Is it too much to suppose some natural operation to take place in the earth, which may decompose the oxygen contained in air from the hydrogen, during the absence of the sun; which on the sun's re-appearance may be again given out in a state highly propitious to vegetation? Oxygen is found to contain carbon; and may not the growing plants imbibe it from the air, and may we not thereby account for its forming a constituent part of all vegetables?

The investigation of these objects presents a wide field for inquiry, and may lead to very important discoveries. From more or less oxygen contained in the earth, may not its proportions account for the fertility of one soil above another? May not the advantages supposed to be derived from loosening the soil, proceed from its being thus rendered in a fit state to imbibe the air? Fallows soon become so hard upon the surface, as neither to be capable of absorption or evaporation. One very important result is placed before the eyes, and within the reach of every practical agriculturist to ascertain, namely, that the evaporation from dung is five times as much as from earth, and is equal on the surface of an acre to 5000 pounds per hour. By making use of dung in its freshest state, the farmer may extend his cropping to one third more land with the same quantity of manure. It is with regret that I have viewed in many parts of the kingdom the quantity of manure which is exposed on the surface, and tends to no good. I am strongly of opinion that in all light soils, if the manure was buried in trenches as I propose, and the turnips sowed above it, that more abundant crops would be procured. By cleaning with the plough, great advantage would be derived to the crop, from the evaporation yielded by the earth. Hot manure might also be used. By fermentation dung is reduced to one half its bulk, and its quality reduced in a much greater proportion. The manure now commonly taken for one acre of broad cast, would, if deposited whilst hot in drills, answer for four acres, and the crop produced be much more.

If the Society of Arts extend their sanction and patronage to my exertions, I shall feel bound to proceed, and to endeavour to bring the experiments to a regular system. The glasses I used for determining the quantity of evaporation were of a bell form, and placed with the open part upon the earth; a quantity of tow was first weighed, ready to wipe off the moisture collected from evaporation within the glass, which tow was then again weighed as exactly as I could after the glass had stood for a given time, and been wiped dry with the tow; and from knowing the contents of the glass I made my calculations. Mr. Robert Wood, watch-maker, of Workington, attended to the experiments made with the glasses.

I have the honour to be, with great respect,

Dear Sir,

Your obedient humble servant,

J. C. CURWEN.

Workington Hall, Jan. 9, 1808.

To C. TAYLOR, M. D. SEC.

DEAR SIR,

IT is with great pleasure and satisfaction that I learnt yesterday from Mr. Arthur Young, the Secretary of the Board of Agriculture, that he has adopted my idea of the great importance of evaporation, and that he has actually ordered Mr. Blunt, optician, of Cornhill, to construct him an instrument for ascertaining the evaporation, which instrument I shall request Mr. Blunt to show to the Society. Mr. Young intends in the course of the summer to make a variety of experiments on the quantity of evaporation produced from different soils, agreeing with me, that the greater or less degree of it influences most materially the luxuriance or growth of the crop.

In all the valuable tracts which Mr. Young has given to the world, he has never adverted to this, and the first knowledge of it as a principle for promoting the growth of crops, was obtained from my account of the Schoose Farm, in the report of the Workington Agricultural Society, of which he is a member.

Being unable to account for the surprising weight of my first crop of cabbages, with only one-third of the manure usually given, I was led to make the experiments I have laid before the Society; and I believe I am not only the first person in Lancashire, but even in Great Britain, who ever thought of ploughing the ground upon the principle I have executed, for promoting the growth of the crops. I flatter myself that my experiments on the economical application of manure, will lead in a high degree to facilitate a more extended cultivation, and obviate the objections which have been started by some persons against the inclosure of waste lands, from their supposition that manure could not be furnished for more than the land at present cultivated. I remain, dear Sir,

Your obedient Servant,

J. C. CURWEN.

Ibbetson's Hotel, Vere-street,
April 8th, 1808.

TO C. TAYLOR, M. D. SEC.

CER-

CERTIFICATES.

A Certificate from Miles Ponsonby, Esq. of Hail Hall, testified that he had seen Mr. Curwen's statement of the rapid progress made by his cabbages in the month of June 1807; that he perfectly recollects viewing them on the Monday, and again on Saturday in the same week; that the improvement in the appearance of the plants was so great, that he imagined the land had been replanted, till Mr. Curwen explained the cause which had produced so great a change.

That he considers Mr. Curwen's plan of managing his potatoes and cabbages as very good garden husbandry, and the best calculated for keeping the land clean, improving the plant, and at the same time enriching the ground, of any that he had observed; and though the mode is entirely new there, he has no doubt but it will be found beneficial, and that it will in a few years be much attended to.

A Certificate from Mr. D. Campbell, Secretary to the Kendal Agricultural Society, stated, that he had attended to the cultivation of potatoes in most parts of Lancashire, and could speak with the greatest precision respecting it in that part of the county, which is north of Lancaster.

That whether they were planted in the lazybed way, by the dibble, or with the plough, they were always set in *rows* from *one end of a field*, or *piece of ground*, to *the other end or side*, with narrower or wider intervals, as the cultivator might deem best suited to the kind of potatoe he was raising. That he never before saw or heard of their being cultivated in beds, in the manner practised and described by Mr. Curwen, and that being more particularly desirous to ascertain whether any such method was pursued in the great potatoe district which lies south-west from Lancaster, including Pilling, the Felde, Rufford, and the neighbourhood of Preston, he applied to George Clayton, Esq. of Lostock Hall, and Robert Hesketh, Esq. of Warrington Hall, gentlemen upon whose accuracy the utmost dependance may be placed, and who informed him, that neither from their own knowledge, nor from inquiries they have made, can they learn that the method of cultivating potatoes alluded to, has been seen or heard of in a tract of country, where more are raised for the market than in any other of the same extent perhaps in the kingdom.

Mr. Campbell further stated, that Mr. Curwen's cabbages were planted at a much greater distance than any he had ever before seen, and their size far exceeded, as a general crop, any that had fallen under his observation; that the ground was perfectly clear from weeds, and from having been frequently turned over by the plough in the intervals, the mould appeared to be in fine order for a subsequent crop, and he conceived that in the two essential points of freedom from weeds, and of the land being in a fine tilth, no garden could exceed it.

Other Certificates respecting the novelty of the method of planting potatoes, as practised by Mr. Curwen, were received from the following gentlemen:

WILLLIAM KNOTT, Summerhill.
MR. SUNDERAND, Ulverston.
J. PENNY MARSHALL, Bolton Oak.

Further Certificates, stating the method to be new, as practised by Mr. CURWEN, for planting both potatoes and cabbages, were received from the following gentlemen:

WALTER GARDNER, Crooks.
WILLIAM HARRISON, Ulverston.

A. **Benson**, Reading.
Henry Richmond Gale, Bardsee Hall.
Jos. **Penny**, Budgefield.
Edward Barrow, Allithwaite Lodge.
Charles Gibson, President of the Lancaster Agricultural Society.
Rev. J. **Barns**, Pennybridge.
Rev. E. **Ellerton**, Colton.
Jos. **Yorker**, Ulverston.
Michael Knott, Thurstonville.
Rev. **Joseph Brooks**, Ulverston.
Thomas Machell, Aynsome.

Also from the following Farmers, resident in the neighbourhood of Lancaster:

Thomas Tart.
William Armstead.
William Staller.
Anthony Eidsforth.
Christopher Atkinson.
Robert Edmondson.

Dear Sir,

Mr. Curwen having informed me, that a question would probably arise in the Society of Arts, &c. relative to the degree of exhalation of water from the earth, and it appearing to me to be intimately connected with various matters in agriculture, I think you will not be displeased at my mentioning a few circumstances, to prove that the object much deserves attention. I conceive that it bears upon the point of showing the great depth to which dung may be ploughed with safety; for when we find, as I have done, that from two to three thousand gallons of moisture are exhaled in a day from an acre of land, and that the quantity varies greatly according to the state of tillage, it should appear that such a vertical stream of vapour must remove all apprehensions of *burying* dung. I also think it goes to the point of hoeing and horse-hoeing such plants as demand much moisture. I have found that the dung in a farm-yard, laid three feet deep and hard trodden by cattle all the winter, has exhaled in the proportion of above four thousand gallons per acre in ten hours; from hence a practical conclusion may be surely drawn. I could much extend these observations, but they are sufficient to convince so enlightened a mind as yours of the propriety of a very extensive pursuit of this inquiry.

I have the honour to be,

With much regard, dear Sir,

Your faithful and very humble Servant,

ARTHUR YOUNG.

Board of Agriculture, May 6th, 1803.

To C. Taylor, M. D. Sec.

The **GOLD MEDAL** *of the Society, being the Premium offered for the comparative Culture of Wheat, was this Session adjudged to* **ROBERT BURROWS**, *Esq. of Great Witchingham, Norfolk, from whom the following Communications were received.*

SIR,

I BEG you will have the goodness to communicate to the Society of Arts, &c. for their approbation, the following result of an experiment upon the comparative culture of wheat, conducted with a view of meeting the wishes of the Society upon the subject; and with that accurate impartiality which I trust will go far towards establishing (especially upon such sort of soils as those on which the experiment was made), that necessary, and among agriculturists, long-agitated question, respecting the best method of depositing the seed of that truly useful and valuable grain.

You will perceive, by the accompanying papers, that my experiment partakes of a twofold nature, having repeated it under two different preparations of the land: first, a clover stubble; a preparation for wheat well and deservedly known in almost every part of the kingdom. The other is a mode of preparing the land for wheat, perhaps, rather peculiar to some districts of this county, and is known by the name of a bastard fallow; and which I shall describe in its proper place. In each instance of trial, I have thought it best to exclude entirely the use of manure, deeming it not unlikely, that though the quantity of manure employed upon the occasion might be exactly proportioned, yet it was not improbable but that there might be some little difference in the quality of such manure so employed; especially when it is considered, that a very large heap of dung or compost was required to spread over the surface of twenty-four acres of land. Under that impression, I chose rather to trust to the previous good condition the land was already in, having for the four preceding years treated both fields exactly similar; and when under turnips two years before, the crops in both fields were two-thirds of them fed upon the land with both sheep and cattle.

I have likewise sent, for the Society's inspection, respective samples of the grain grown, together with specimens of the soils of each field in which the experiments were made, judging the latter step necessary, in case my description of the soil may not be perfectly and clearly understood. The Society, if they think proper, may avail themselves of a chymical analysis thereof.

I have the honour to remain, Sir,

Your most obedient humble Servant,

ROBERT BURROWS.

Great Witchingham, near Norwich,
January 28, 1808.

To C. TAYLOR, M.D. SEC.

The

The following is the Account of an Experiment on the comparative Culture of Wheat, made in the Year 1807, *by* Robert Burrows, *of Great Witchingham, in the County of Norfolk.*

Clover Stubble Experiment.

In the autumn of 1806, I set out by the chain twelve statute acres of land in the middle of a field, containing by survey twenty-six acres; I again divided the twelve acres into subdivisions of four acres each: the soil, a deep sandy loam, tolerably rich, and what in the county of Norfolk is usually termed, an excellent turnip soil. I considered myself as extremely fortunate this year, in being able to appropriate to the experiment a portion of land so exactly similar in regard to quality of soil, as is not often to be met with in this county, where lands in some of the best districts are remarkable for varying materially, even in the same field, especially if that field is of any considerable extent. With so favourable an opportunity as the present, in the middle of a large field, without a tree, or even an hedge-row of sufficient height to have any injurious influence over my future crop, I commenced with considerable eagerness an experiment I had long been desirous of bringing to a crisis, and which I had twice before begun, and as often, from the interference of local circumstances, been obliged to abandon.

On the 22d of September 1806, and the two following days, I commenced the experiment, by ploughing the whole twelve acres nearly six inches deep, laying the same into stitches of ten yards in the breadth, which, as the soil was perfectly dry, I considered stitches that width the most convenient for the different operations I was about to perform. Upon the 25th of the same month I sowed the broadcast, two Winchester bushels per acre, harrowing in the seed immediately after, two, three, or more times in a place, until the whole or nearly the whole of the seed was buried. Such few remaining grains as were still uncovered I pressed into the earth, by causing a heavy roller to pass over the ridges the same way they were ploughed; an operation considered highly beneficial upon loose pulverised soil after seeding them, as the roller not only compresses the soil, but, in the case of broadcast particularly, it buries sufficiently deep in the earth for them to vegetate, (such grains as may have escaped the harrows,) and which, but for this operation, would become a prey to rooks and other birds; likewise, if the rolling is well performed, it prevents the seeds of a variety of weeds from vegetating.

On the same day the broadcast was finished, I employed three men to dibble the four acres on one side of the broadcast already sown. They began and finished the dibbling upon that and the two following days, in equidistant rows of four and a half inches asunder—the usual method of dibbling practised in the county of Norfolk, and which general method I thought necessary to adhere to in the present experiment. Two such rows upon a furrow nine inches wide, and the holes three inches apart from each other, or, upon an average, four holes to a foot measure, is considered as equivalent to one now drilled by Cooke's machine upon the same sized furrow. Three children follow one man, dropping the grain from two to four in each hole. The quantity of seed made use of upon this occasion was exactly six pecks per acre. At the time the dibbling was going on, two men and a boy, with Cooke's drill machine, drilled the four acres on the other side of the broadcast, in equidistant rows of nine inches,—a distance, perhaps, to be preferred to all others in drilling: for, if the space between the rows is less than nine inches, the horse-hoe can scarce be used with safety; and without the use of the hoe, drilling can only be called imperfect husbandry: and though, in the experiment which I am here detailing, drilling has only turned out second best, yet I am so well persuaded of its being an excellent practice on many kinds of soils in various parts of the kingdom, that I should be sincerely sorry to see the active and intelligent farmer reject it from his system of husbandry. For my own part, though the present result is contrary to my expectation, yet I shall not dismiss the drill from my farm, nor cease to use it even in depositing my future wheat crops. The quickness and ease with which the business of wheat sowing is performed; the completeness and facility with which weeds of various kinds may be eradicated, together with the neat and garden-like appearance of a crop under the drill system, will ever be with me powerful persuaders to its use; and perhaps, even in the present instance, its failure may properly be attributed to the loose and pulverised nature of the soil; which, rather than loosen still more by the frequent operation of horse-hoeing, ought to have been compressed by the feet of sheep or neat cattle, or by rolling, in those early spring months when the plants begin to tiller on the surface of the earth. The quantity of seed drilled upon the last four acres was exactly six pecks and a quarter per acre: the seed wheat made use of upon such occasion was the old Kentish red.

After having made a few observations upon the state and appearance of the crop under experiment, at various times between seeding and harvest, I shall then proceed to a statement of the expenses of cultivation, and an account of the produce. I shall afterwards consider the fallow experiment by itself, in the same manner as I have done the present; beginning with the state and preparation of the soil, the time and method of seeding, &c.

A few days after the various operations of dibbling, drilling, and sowing, were completed, the wheat in each instance made its appearance; the broadcast first, as probably that was not buried so deep in the earth as in the other two divisions, nor at such even distance from the surface: after the broadcast, the dibbled came up; and last of all the drilled, which latter, when all three were completely above ground, looked much more regular and beautiful than either of the others. From being sown early, the frosts of the winter never entirely destroyed their green verdure. During the winter season the broadcast, owing probably to its being thicker upon the ground, seemed to have the advantage in point of appearance, and maintained the same until the beginning of the month of March, when the drilled began to assume a very apparent superiority, by exhibiting a fine dark green hue, together with a broad reedy leaf. This decided advantage it maintained the greater part of the summer, until, having fully shot the ear, the whole field wore one general appearance and colour. Next to the drilled, the dibbled greatly exceeded the *broadcast* in point of health and promise; the latter, particularly towards the end of the month of May, lost its colour very fast, and looked rather pale and sickly throughout the rest of the summer. The circumstance of its looking more pale and sickly than either of the other two divisions, I could only attribute to its being too thick to admit a proper circulation of air between the plants, which I consider as one of the evils of broadcast crops: however, though aware that such might be the case, I conceived it necessary, in order to render the experiment useful and complete, to use, as near as I could, the same relative proportions of seed as are thought requisite by intelligent and practical farmers in general.

In stating the expenses, I shall forbear saying any thing of the rent, parochial rates, &c. attached to the land: as they are the same in each instance, and vary perhaps in their nature in different districts in the kingdom: as such, I shall leave individuals to apply them to their own particular situations, whilst I confine myself to such immediate expenses as attended each individual method from the time of seeding to the time of reaping the same, beginning in the order I have described them above.

Expenses of four Acres of Broadcast Wheat.

	£.	s.	d.
Seed, eight bushels, at 8s. per bushel -	3	4	0
One man half a day sowing the same -	0	1	0
Carried forward, £.	3	5	0

Harrowing

	£.	s.	d.
Brought forward,	3	5	0
Harrowing, two horses one day, with a lad attending the same - - -	0	5	9
Rolling the four acres, two horses with a lad ½ a day	0	2	10½
Ploughing the land once, at 5s. per acre -	1	0	0
The season of spring being remarkably wet, brought up many weeds of various kinds, particularly the red poppy, a species of weed the field, where the experiment was made, was much subject to. Here will appear, under such circumstances, the advantage of horse-hoeing, which will be found materially to lessen the expense of weeding, which, in crops not planted in regular rows, must be eradicated either by the small hand-hoe, or by the hand only; and which methods were resorted to in the present broadcast crop, and done principally by women; the expense 8s. 8d. per acre - - - - -	1	14	8
Reaping four acres at 8s. 6d. per acre -	1	14	0
Threshing and carrying to market fourteen quarters two bushels and half a peek -	2	2	9½
Expenses of cultivating four acres of broadcast wheat - - -	£.10	5	0

Produce of four Acres of Broadcast Wheat.

	£.	s.	d.
Fourteen quarters two bushels and half a peck, sold to the merchant at 64s. per quarter -	45	13	0
Value of the straw grown upon the above four acres of broadcast wheat, per acre two tons one hundred weight eight pounds, making in the whole			

eight

	£.	s.	d.
eight tons four hundred weight two stone four pounds weight of straw, consumed, by covenant of lease, upon the farm; yet in the present instance I shall estimate the straw at the price given at the nearest market, Norwich, where straw is now selling at 3s. per hundred weight -	24	12	10
Value of the produce of four acres - -	70	5	10
Expenses of cultivating the four acres of broadcast wheat - - -	10	5	0
	£.60	0	10

Weight of the grain, per Winchester bushel, as weighed at the time of sale, sixty-one pounds.

Expenses of Dibbling four Acres of Wheat.

	£.	s.	d.
Seed, six bushels, at 8s. per bushel - -	2	8	0
Ploughing the land, at 5s. per acre -	1	0	0
Rolling the land before dibbling, a lad and two horses half a day - - -	0	2	10½
Dibbling four acres, at 10s. per acre -	2	0	0
Bush harrowing to bury the seed, one horse and boy half a day - - -	0	1	7½
Weeding, four women four days hand-hoeing, at 8d. each day - - -	0	10	2
Do. four women again two days, second time of hand-hoeing - - -	0	5	1
Do. three women two days, drawing by hand what escaped the hoes - - -	0	4	0
Reaping the four acres, at 8s. 6d. per acre -	1	14	0
Carried forward,	£. 8	5	9

	£.	s.	d.
Brought forward,	8	5	9
Threshing and carrying to market seventeen quarters one bushel and a half of wheat -	2	11	6¾
Expenses of cultivating four acres of dibbled wheat £.	10	17	3¾

Produce of four Acres of Dibbled Wheat.

	£.	s.	d.
Seventeen quarters one bushel and a half of wheat carried to market, at 64s. per quarter -	55	0	0
Value of the straw upon the four acres of dibbled wheat, estimated as in the foregoing experiment, two ton two hundred weight four stone per acre, on the whole, eight tons ten hundred weight, at 3s. per hundred weight, the price at Norwich	25	10	0
Value of the produce of four acres of dibbled wheat	80	10	0
Expenses of the cultivation of four acres of dibbled wheat - - - - -	10	17	3¾
£.	69	12	8¼

Weight of the grain, per Winchester bushel, weighed at the time of sale, sixty-one pounds and a half.

Expenses of Drilling four Acres of Wheat.

	£.	s.	d.
Seed, six bushels one peck, at 8s. per bushel -	2	10	0
Ploughing the four acres once, at 5s. per acre	1	0	0
Rolling the land before the drill machine to close and level the same, boy and horse half a day	0	1	7½
Two men and a horse half a day, together with a boy to lead the horse drilling the wheat -	0	3	7½
Carried forward, £.	3	15	3

Harrowing,

	£.	s.	d.
Brought forward,	3	15	3
Harrowing the seed to cover it with earth, two horses and a boy half a day - -	0	2	10½
March 12, one man half a day 1s. a horse half a day 1s. 3d. together with a lad to lead 4½d. hoeing first time - - -	0	2	7½
April 4th, repeated the hoeing - -	0	2	7½
May 12th, one woman a day drawing such weeds as escaped the horse-hoe, by being intermixed in the rows of wheat - - -	0	0	8
Reaping the four acres, at 8s. 6d. per acre -	1	14	0
Threshing and carrying to market sixteen quarters three bushels of wheat - -	2	9	1½
Expenses of cultivating four acres of drilled wheat £.	8	7	2

Produce of four Acres of Drilled Wheat.

	£.	s.	d.
Sixteen quarters three bushels, sold to the merchant at 64s. per quarter - -	52	8	0
Value of the straw grown upon the four acres, estimated as in the two foregoing experiments, one ton nineteen hundred weight two stone four pounds per acre, or, on the whole four acres, seven tons seventeen hundred weight one stone two pounds, at 3s. per hundred weight	23	11	5
Value of the produce of the four acres of drilled wheat - - - £.	75	19	5
Expenses of cultivating the four acres of drilled wheat, to deduct - - -	8	7	2
£.	67	12	3

Weight of the grain per Winchester bushel, weighed at the time of sale, sixty pounds.

Before I proceed to my statement of the fallow experiment, I shall take a comparative view of the above results in as concise a manner as possible, by briefly stating the expenses of cultivating an acre of land under each respective mode; applying thereto the local expenses of the parish or neighbourhood where the experiment was conducted.

Expenses of Cultivating an Acre of Wheat after the Broad-cast Method of Husbandry.

	£.	s.	d.
Rent of land per acre	1	10	0
Composition for tythes	0	7	0
Parochial rates	0	9	6
Ploughing once for the crop	0	6	0
Seed	0	16	0
Sowing	0	0	3
Harrowing in the seed	0	1	5¼
Rolling and completing the work	0	0	8½
Weeding	0	8	8
Threshing and carrying to market	0	10	8¼
Interest upon capital employed, say 10l. per acre, the lowest rate at which a farmer can now stock his land at per acre	0	10	0
	£. 5	8	9

Expenses of Cultivating an Acre of Dibbled Wheat.

	£.	s.	d.
Rent of an acre of land	1	10	0
Composition for tythes	0	7	0
Carried forward, £.	1	17	0

Parochial

	£.	s.	d.
Brought forward,	£.1	17	0
Parochial rates	0	9	6
Ploughing once for the crop	0	6	0
Seed	0	12	0
Dibbling	0	10	0
Harrowing in the seed after the dibbler	0	0	5
Weeding	0	4	9½
Reaping	0	8	6
Threshing and carrying out the crop	0	12	10½
Interest upon capital employed	0	10	0
	£.5	11	1

Expenses of Cultivating an Acre of Drilled Wheat.

	£.	s.	d.
Rent	1	10	0
Composition for tythes	0	7	0
Parochial rates	0	9	6
Ploughing for the crop	0	6	0
Seed	0	12	6
Drilling	0	0	10½
Harrowing in the seed	0	0	10¾
Rolling the ground before drilling	0	0	4¾
Weeding	0	1	3¾
Reaping	0	8	6
Threshing and carrying to market	0	12	3½
Interest upon capital employed	0	10	0
	£.4	19	3

	£.	s.	d.
Produce of an acre of broadcast	11	8	3
Expenses of cultivating an acre of do.	5	8	9
Profit	£.5	19	6

	£.	s.	d.
Produce of an acre of dibbled wheat -	13	15	0
Expenses of cultivating an acre of dibbled wheat	5	11	1
Profit - - -	£.8	3	11

	£.	s.	d.
Produce of an acre of drilled wheat -	13	2	0
Expenses of cultivating an acre of do. -	4	19	3
Profit - - - - -	£.8	2	9

This statement is upon the supposition that the straw is of no other value to the grower than to convert into manure upon the premises, which is really the case with farmers in general, who are restricted from selling their straw by a covenant in their lease. Under circumstances where the straw is of a real marketable value, the disadvantages of the broadcast mode of husbandry will appear somewhat less; as a little must be allowed for its superiority in weight of straw over the drilled.

Experiment on the Comparative Culture of Wheat, upon a Preparation called a Bastard Fallow, by Mr. ROBERT BURROWS, *of Great Witchingham, in the County of Norfolk.*

Before I enter upon a description of the method pursued in the present instance, together with the result of the produce obtained, I shall first endeavour to explain what is meant by the husbandry term bastard fallow. From what I have seen of the agriculture of other counties, it appears to me to be a practice peculiar to the county of Norfolk; and even there I am glad to acknowledge, that together with the real fallowists of other counties, its advocates are daily growing fewer. Surely it must be absolute barbarism in husbandry, to plough up a field of clover or grass layer, in the midst of the hot dog-days of summer, and to embrace, as it were, with eagerness every opportunity of exposing its surface to the exhausting influence of a scorching summer's sun; yet such, if we may judge from the practice, seems to be the wish of every description of fallowists. The kind of fallow under consideration is ploughed up immediately upon the first rain sufficiently heavy to enable the plough to work after Midsummer; then again before harvest, and two or three times more before sowing the wheat. Such repeated ploughings, besides the injury they do in exhausting the soil, must undoubtedly be charged as labour to the account of the ensuing crop; nor is the farmer aware, that by forcing into existence every particle of vegetable matter the soil is capable of affording, though by that means he may obtain a considerable deal of straw to the crop immediately in view, yet he is by such practices reducing his land to a state of poverty and exhaustion incapable of affording sufficient nourishment for ensuing crops. Injudicious and repeated summer ploughing, I have not a doubt, impoverishes land, and renders it more barren than heavy and abundant crops of either hay or corn; and I trust that the increasing influence of public societies, established with a view of disseminating useful practical opinions, together with the example of liberal and enlightened farmers, will soon have the desirable effect of banishing from the husbandry of these kingdoms, those ridiculous and absurd prejudices that have so long disgraced that first of all professions, and grand source of all wealth—Agriculture.

In conformity to the practice above alluded to, upon the 24th, 25th, and 26th of July 1806, I ploughed up twelve acres of a clover stubble, in a field adjoining to the one where the first experiment was made, and of a similar soil, that is to say, a tolerably good sandy loam. This ploughing was only just fleetly skimming the surface with the Norfolk wheel plough, about two inches deep, cross ploughed the twelve acres again about the 1st, 2nd, and 3rd days of September, harrowing the same well three times in a place. In this state the field lay until after harvest; then, about the beginning of October ploughed the same again; harrowing the land after the plough as before: I should here observe, the two last-mentioned ploughings were about 4½ inches in depth. On the 28th, 29th, and 30th of October, I had the whole twelve acres divided by the chain in divisions of four acres each laying, two of those divisions into stitches of twelve small furrows, each furrow nine inches wide, making the stitches three yards each across. These two divisions were now fit for the operation of dibbling and drilling, which immediately commenced; the first by dibbling two rows of holes upon each furrow, equidistant from each other four inches and a half, bush-harrowing directly after to fill up the holes with earth: whilst this was performing, a man, a boy, and a horse, put in the four acres adjoining, with Cooke's drill-machine, in rows nine inches asunder; each stitch formed exactly one bout for the machine, the horse up in one furrow and back in the other, which was effected by only moving the shafts of the machine nearer to the end of the beam, holes for that purpose being made in all Cooke's machines; thus upon each stitch were twelve rows, or one row upon a furrow, equal, as I have before observed, to the two rows of dibbled; and in this instance exactly an equal quantity of seed used as in the dibbled work, an account of which will appear in the statements that follow. These two operations were performed upon the 31st of October, and 1st of November, at the same time the wheat was sown on the division appointed for the broadcast experiment, and had the same neatly ploughed under, in depth about three inches, laying the stitches into the same size as in the two foregoing experiments. The seed made use of was likewise of the old Kentish red stock, and had been sown upon the farm without changing, for many years past; nor was any manure made use of, for reasons mentioned in the first part of this paper.

The appearance of the crop throughout the summer was much the same as noticed in the former experiment: the drilled crop, from its first coming up till the whole field was in ear, always looked the richest and most pleasing to the eye. The expenses of weeding, &c. were nearly the same as in the clover stubble field, as will appear hereafter, and as to the deficiency in point of produce, I can attribute it to no other cause than the pernicious one above complained of, viz. the barbarous system of fallowing. The result of this latter experiment confirms me more than ever of the justness of my first notion, in not making use of manure in my experiment; as the land in this fallow experiment was in itself richer, and I believe, in regard to its state of condition, had rather the advantage of the clover stubble field. I believe in districts where this kind of husbandry is most prevalent, an ample manuring is in general made use of; yet after the additional expense of manure, an observer may easily perceive the crop is not more productive, nor even so much so, as a simple clover lay without any manuring whatever. Hence it is evident the fallowist fallows away as much, or more vegetable matter, than an ample manuring will again restore to the soil.

Expenses of four Acres of Broadcast Wheat.

	£	s.	d.
Ploughing the land three times, at 5s. per acre each time - - - - -	3	0	0
Seed, eight bushels - -	3	4	0
One man ½ a day sowing the same -	0	1	0
Ploughing the seed under, four acres, at 5s. per acre	1	0	0
Weeding, as in the former instance, done principally by hand, or the small hand-hoe: put out the work to two women, at 4s. per acre the first time, and 2s. per acre the second time of hoeing, together with three days work each at 8d. per day each, drawing by hand the remaining weeds that escaped the twice hoeing -	1	8	0
Reaping the four acres, at 8s. 6d. per acre -	1	14	0
Threshing and carrying to market, twelve quarters four bushels and half a peck of wheat -	1	17	6½
Expenses of cultivating 4 acres of broadcast wheat	£12	4	6½

Produce of four Acres of Broadcast Wheat.

	£.	s.	d.
Twelve quarters, four bushels, and half a peck, sold to the merchant at 64s. per quarter -	40	1	0
Value of the straw grown upon the above four acres, estimated as in the clover stubble experiment, at 3s. per hundred weight, seven ton five hundred weight five stone two pounds - -	21	16	11
Value of the four acres of broadcast	£61	17	11
Expenses of cultivating the four acres of broadcast wheat - - -	12	4	6½
Profit -	£49	13	4½

Weight of the grain per Winchester bushel at the time of sale, fifty-nine pounds and a half.

Expenses of Dibbling four Acres of Wheat.

	£.	s.	d.
Ploughing the land four times for the crop	4	0	0
Seed, seven bushels, at 8s. per bushel	2	16	0
Dibbling four acres, at 10s. per acre	2	0	0
Rolling the land before dibbling, a lad and two horses half a day	0	2	10½
Bush harrowing to bury the seed, a lad and one horse half a day	0	1	7½
Weeding, at 4s. per acre the first time, and 2s. the second time, two women four days drawing weeds by hand	1	9	4
Reaping the four acres, at 8s. 6d. per acre	1	14	0
Threshing and carrying to market fourteen quarters one bushel one peck, at 3s. per quarter	2	2	5½
Expenses of cultivating four acres of dibbled wheat	£14	6	3½

Produce of the four Acres of Dibbled Wheat.

	£.	s.	d.
Fourteen quarters one bushel one peck, sold to the merchant, at 64*s.* per quarter	45	6	0
Value of the straw of the four acres of dibbled wheat, at 3s. per cwt. seven tons fourteen cwt. two stone four pounds	23	2	10
Value of the produce of the four acres of dibbled wheat	68	8	10
Expenses of cultivating the four acres of dibbled wheat	14	6	3½
Profit	£54	2	6½

Weight of the grain per Winchester bushel at the time of sale, fifty-nine pounds and a half.

Expenses of Drilling four Acres of Wheat.

	£.	s.	d.
Ploughing four acres four times, at 5s. per acre each time - - -	4	0	0
Seed for the four acres, at seven pecks per acre, seven bushels, at 8s. per bushel -	2	16	0
Rolling the land for the drill, half a day, lad and one horse - - -	0	1	7½
One man, a lad, and a horse, half a day drilling the four acres; the man at 2s. the horse at 2s. 6d. and the lad at 9d. per day each -	0	2	7½
Harrowing after the seeds to close the drills, two horses and lad, say half a day -	0	2	10½
One man half a day, with a horse and a lad hoeing the first time - -	0	2	7½
Second hoeing, though not absolutely necessary, as before - - -	0	2	7½
Drawing weeds by hand, one woman a day -	0	0	8
Reaping the four acres, at 8s. 6d. per acre -	1	14	0
Threshing out and carrying to market thirteen quarters seven bushels and three pecks of wheat, at 3s. per quarter - -	2	1	11
Expenses of cultivating the four acres of drilled wheat	£11	4	11½

Produce of four Acres of Drilled Wheat.

	£.	s.	d.
Thirteen quarters seven bushels three pecks of wheat sold to the merchant, at 64s. per quarter	44	14	0
Value of the straw, at 3s. per cwt. seven tons eleven cwt. three stone six pounds -	22	14	3
Value of the produce of four acres of drilled wheat	£67	8	3
Expenses of cultivating the four acres of drilled wheat	11	4	11½
Profit -	£56	3	3½

Weight of the grain per Winchester bushel at the time of sale, fifty-eight pounds three quarters.

Again, as in the first experiment, I shall state the expenses and produce of a single acre under each mode of husbandry, and apply it, as in the former case, to the parcular spot where the experiment was conducted.

Expenses of cultivating an Acre of Broadcast Wheat, under a Fallow System of Husbandry, without Manure.

	£.	s.	d.
Rent of an acre of land - -	1	10	0
Composition for tythes - -	0	7	0
Parochial rates - - -	0	9	6
Ploughing for the crop, four times -	1	0	0
Seed - - - -	0	16	0
Sowing - - - -	0	0	3
Weeding - - - -	0	7	0
Reaping - - - -	0	8	6
Threshing and carrying to market -	0	9	4½
Interest upon the capital employed, say, as in the former estimate, £10 per acre -	0	10	0
Expenses of cultivating an acre of broadcast wheat	£5	17	7½

Expenses of cultivating an Acre of Dibbled Wheat.

	£.	s.	d.
Rent of land - - -	1	10	0
Composition for tythes - -	0	7	0
Parochial rates - - -	0	9	6
Ploughing for the crop, four times -	1	0	0
Seed, seven pecks - - -	0	14	0
Dibbling - - - -	0	10	0
Bush-harrowing after dibbling, together with rolling the land for the dibbles - -	0	1	1½
Carried forward,	£4	11	7½

Weeding

	£.	s.	d.
Brought over,	4	11	7½
Weeding - - -	0	7	4
Reaping - - -	0	8	6
Threshing and carrying to market -	0	10	7¼
Interest upon capital - -	0	10	0
Expenses of cultivating an acre of dibbled wheat	£6	8	0¾

Expenses of cultivating an Acre of Drilled Wheat.

Rent of land - - -	1	10	0
Composition for tythes - -	0	7	0
Parochial rates - - -	0	9	6
Ploughing for the crop, four times -	1	0	0
Seed, seven pecks - -	0	14	0
Drilling - - - -	0	0	7¾
Harrowing in the seed and rolling before the drill	0	1	1½
Weeding - - - -	0	1	5¾
Reaping - - - -	0	8	6
Threshing out the crop and carrying to market	0	10	5¾
Interest upon capital - - -	0	10	0
Expenses of cultivating an acre of drilled wheat	£5	12	8¾

	£.	s.	d.
Produce of an acre of broadcast wheat	10	0	3
Expense of an acre of ditto -	5	17	7½
	£4	2	7½
Produce of an acre of dibbled wheat	11	6	6
Expense of an acre of ditto -	6	8	0¾
	£4	18	5¼
Produce of an acre of drilled wheat	11	1	0
Expenses of an acre of ditto -	5	12	8
	£5	8	4

Having now brought each set of experiments to a conclusion, I shall here observe, that I have been as correct (even to the expense of a single farthing) as so large an experiment would admit of; and that however tedious and troublesome it has been to me, by often interfering with other departments of my business, yet such has been my ardent wish to see fairly decided so important a question in agriculture, as the best method of depositing the seed of any grain whatever, that I have never suffered any operation in the conducting the present business to be performed without my own personal inspection; and, in estimating the expenses, I have been cautious in fixing them within the moderate bounds of near and economical husbandry. In the account of my fallow experiment, I have charged nothing for the harrowings which took place subsequent to the two middle ploughings; my reasons for not doing it were on account of finding by experience in the conducting of the work itself, that in those long days a man, two horses, and plough, would do nearly one acre and three quarters per day, which at 2s. 6d. per day each horse, and 2s. the man is 7s. per day; an acre and three quarters at 5s. per acre, is 8s. 9d. per day. The overplus, 1s. 3d., I let go to the expense of harrowing; nor have I charged any thing for harvesting the wheat, against which I set the chaff, &c. from the barn doors at the time of threshing, the value of which I think will just about cover the expense of carting home in harvest. In the following manner I obtained the criterion by which I estimated the weight of straw grown upon an acre of each. In the beginning of harvest, one man went with me into each field, and in an exact and careful manner we set apart one square perch in each division, chosen from an average part of the field; I had the same reaped and tied up in sheaves, and which stood to weather in the field the necessary time. Then I had them all conveyed to the barn, there separately threshed, and the grain from each perch measured, together with the straw nicely weighed; the result thereof is annexed.

Clover Stubble Experiment.

Measure of grain in a square perch of the broadcast wheat.	Weight of straw in a square perch of the broadcast wheat.
11¼ pints.	2 stone ¾lb.
Winchester measure.	14lbs. to the stone.

Clover Stubble Experiment.

Measure of grain in a square perch of the dibbled wheat.	Weight of straw in a square perch of the dibbled wheat.
13½ pints.	2 stone 1¾ lbs.
Winchester measure.	14lbs. to the stone.

Clover Stubble Experiment.

Measure of grain in a square perch of the drilled wheat.	Weight of straw in a square perch of the drilled wheat.
13 pints.	1 stone 13½ lbs.
Winchester measure.	14lbs. to the stone.

Fallow Experiment.

Measure of grain in a square perch of the broadcast wheat.	Weight of straw in a square perch of the broadcast wheat.
10 pints.	1 stone 11½ lbs.
Winchester measure.	14lbs. to the stone.

Fallow Experiment.

Measure of grain in a square perch of the dibbled wheat.	Weight of straw in a square perch of the dibbled wheat.
11½ pints.	1 stone 13 lbs.
Winchester measure.	14lbs. to the stone.

Fallow Experiment.

Measure of grain in a square perch of the drilled wheat.	Weight of straw in a square perch of the drilled wheat.
11¼ pints.	1 stone 12½ lbs.
Winchester measure.	14lbs. to the stone.

CER-

CERTIFICATE.

We whose names are here undersigned, do certify, that the foregoing set of experiments upon the comparative culture of wheat have been conducted in an able and masterly manner, and fully calculated to attain the object in view, namely, the ascertaining of the best mode of depositing the seed in the ground; and we do likewise further certify, that the nature and condition of the soil is as within described, namely, a fine sandy loam, in a high state of cultivation. We have also viewed the crop during the time of growing, and do pronounce it to have been kept perfectly free and clear from weeds of every description, in the manner and at the expense within stated by the cultivator, Mr. ROBERT BURROWS, of Great Witchingham, in the county of Norfolk.

PETER LE NEVE FOSTEE, Great Witchingham.
JOHN ELMER, Great Witchingham.
WILLIAM FITZ MAY, Great Witchingham.
JOHN BOND, Cawston.
JAMES NORTON, Cawston.

The SILVER MEDAL *of the Society was this Session voted to* J. BUTLER, *Esq. of Bramshott, Hants, for his Improvement of Waste Land, and the following Communication was received from him.*

SIR,

In the year 1802 I purchased an estate, situated in the parish of Bramshott, in the county of Hants, of which seventy acres and upwards were then waste lands, growing a little a little timber, furze, and alder, and supporting a few cows in the summer, but never cultivated or considered worth that expense.

From particular engagements at the time, I did not begin any improvement till 1804, when I found sixty-five acres and a half (statute) of the said waste lands in the following state: twelve acres, the scite of old fish ponds, growing nothing but reeds and rubbish; eighteen acres one rood thirty-seven perches, affording a little sour grass and a few alders in wet places; twenty-seven acres three roods one perch, quite a morass or bog, with a few alders; and seven acres one rood four perches of very indifferent furze.

As the greatest part of the waste was filled with innumerable springs that deluged the whole, and caused the bog to be saturated throughout the year, I considered that draining was the first necessary step to be taken; with this view I made an open cut or ditch, of five to seven feet deep or more, in the lowest part of the bog, to let out the stagnated water, and ascertain with precision the cause that produced it. Having obtained the lowest possible fall by the open cut or ditch, I caused other cuts to be made to the heads of different springs which fed the land, occasionally boring with the auger, that no spring might be passed over; and I then laid the open cuts or drains with stones from three to twelve feet below the surface, according to circumstances, to carry off the water, observing always to keep the level.

At the highest ground I found rocks under which the principal springs lay, at the distance of at least fifteen feet, and from thence an immensity of water gushed out, which was easily passed off through the drains, and I had the satisfaction to find, that in the course of two years the whole waste became perfectly dry, and so continued.

The extent of land thus drained being great, the cost of course is very considerable, and amounts to the sum of 338l. 2s. 11d.

During this I grubbed the greatest part of the land, which from the stems of oak and other timber that had formerly grown there, as well as the alder, furze, and some timber standing at the time I made the purchase, was no inconsiderable work, and cost for each oak stem ninepence, and for the soil on which the alders and furze grew, sixpence per rod, amounting in the whole to the sum of 95l.

The ground being now cleared, I ascertained, by the means of a water level, the position of a little brook which ran through the waste land, and found that it was practicable to turn water over thirty acres of it. This being an object of the first consequence, I spared neither pains nor expense to accomplish it; I removed the high banks round the fish ponds, which contained some thousand loads of soil, filled up very deep ditches and stew ponds, and laid several acres on an inclined plane; burnt the roots and rubbish, and prepared, by levelling and making water carriages, thirty acres for irrigation, of which sixteen acres, though rough and some pasture as before described, had by draining and feeding began to improve considerably; and in the spring of 1806, I was enabled to turn the water over such sixteen acres, from which I derived a tolerable crop of hay in that summer; feeding it harder afterwards, and watering it the following winter, there was a good supply of feed for sheep till the latter end of April, when it was laid up and watered as before, but with far better success, as the crop was not only greatly improved in quality, but likewise in quantity, producing more than two tons to an acre throughout the sixteen acres.

The residue of the thirty acres prepared for irrigation as before stated, formerly fish ponds and other rough lands, but lately levelled and sown with perpetual grasses, is now looking remarkably well, and will certainly be in readiness to receive the water, as soon as the land is firm enough for that purpose.

In accomplishing this work I had the assistance of Joseph Trigger, who lived with and managed the water meadows of the late Mr. Bakewell of Dishley, for more than twenty years; and it would be an act of injustice to him not to say, that the said land is prepared for a water meadow in a masterly style; this cost me not less than 223l.

As soon as I perceived the effect of my drains on the bog, which was composed of a good deep peat, I pared by hand thirteen acres of it, which I burnt, and spread the ashes; then ploughed the land once, and sowed it with cole seed in the month of July. The crop turned out very good, and fed one hundred and sixty-two shear hogs (Leicester) for two months; after which I ploughed it once only, and sowed it with white oats in the month of April 1807: at first the oats appeared sickly, but receiving a few warm showers in May, they recovered and flourished exceedingly, making a most excellent appearance, to the astonishment of the neighbourhood; for when reaped, they were estimated at from ten to thirteen quarters per acre, some parts being preferable to others, but the whole good; and I have no doubt, for at present they are not threshed, that the crop will amount to its estimate.

In the course of last year I pared seven acres more of the said bog, and burnt and spread the ashes in a similar way to the former, and sowed it with cole seed from one ploughing in July last, which likewise turned out a most excellent crop, and supported seventy-two large sheep on it for more than two months.

The expense of paring and burning the twenty acres came to 29l. 10s.

The remaining waste land being a lighter peat, mixed more with sand, I did not think it adviseable to pare and burn, but contented myself with fallowing it for turnips, with which it was sown last summer; but from the indifference of the season, the crop did not prove abundant, yet as much so as I had any reason to expect; and I have no doubt, by proper management of it, though by far the worst of the waste, it will shortly become very useful land, and produce in succession good turnips, barley, and seeds.

On a review of the foregoing statement, it will appear that the expense attending the improvement of the waste has been great; but it will be recollected, that the quantity of land reclaimed is very considerable, the greatest part of which has been drained and grubbed, and the face of it entirely changed; that on the comparison I now submit, I feel great satisfaction in being enabled to assert, in the judgment of able men, that at the time I made the purchase, the waste land was not worth more than 5s. per acre per annum on an average, which amounts to 16l. 7s. 6d. and that it is now worth and let as follows:

	£.	s.	d.
Sixteen acres of water meadow, 3l. per acre	48	0	0
Fourteen do. will shortly be as valuable -	42	0	0
Carried forward, £.	90	0	0

Brought forward,	£.90 0 0
Twenty do. of reclaimed bog, 2l. per acre -	40 0 0
Fifteen and a half do. lighter peat, 1l. per acre	15 10 0
By the year - - -	£.145 10 0

I have not pointed out minutely every step that has been taken to drain, to irrigate, or improve the said waste lands, because the subject is generally so well understood; but I trust I have stated sufficient to prove, that the soil, thus reclaimed, is turned to a great and lasting benefit.

J. BUTLER.

Bramshott, Hants,
Jan. 28, 1808.

To C. TAYLOR, M. D. SEC.

Certificates were received from the following persons, in testimony of the accuracy of Mr. Butler's statement.

SAMUEL MENCE, Curate of Bramshott.
GEORGE CURTIS, Surgeon.
FRANCIS DENYER, Overseer.
JAMES CHASE, Churchwarden.
WILLIAM MONEY, Yeoman.
JOHN FULLECH, Yeoman.
JOHN ROWLAND, Tenant of the Premises.

The SILVER MEDAL *of the Society was this Session voted to* MR. SAMUEL CURTIS, *of Walworth, for planting an extensive Orchard at Bradwell in Essex. The following Communications were received from him.*

SIR,

I TAKE the liberty of sending you an account of an undertaking, for which I hope I shall be entitled to some notice from the Society of Arts, &c. I do not know whether they have offered premiums or medals for planting fruit trees, nor do I suppose it is always requisite, as I understand the Society confer their favors without such offers for matters they think deserving of them.

Two years ago I took a small farm in Essex, (a county where fruit is scarce,) consisting of near fifty acres. As the soil appeared proper, and the aspect favorable, I converted the whole into an orchard, by planting one hundred trees on each acre, in the following manner, viz. The fruit trees are placed in rows one rod asunder; between each row is a space of two rods; the plants are cherries, and apples or pears alternately, so that one half of the plantation consists of cherry trees. In about twenty or thirty years the apple and pear trees will require the whole of the ground; the cherry trees are then to be cut out, leaving the apple and pear trees uniformly two rods asunder each way, and in straight lines.

The orchard is now completed with the best kinds known or produced in the nurseries, in the whole nearly five thousand standard trees. They are well staked, and have been properly pruned twice a year. Farming crops have been since produced on the same ground as good as formerly, the plough being allowed to go within two feet of the trees each way, so that for many years to come the land will pay the expenses, and yield a profit exclusive of the fruit. I have in one part planted medlars, quinces, plums, walnuts, and other trees, to make the fruit collection as complete as possible, and I have spared no expense which could tend to improve the whole.

I shall make it an object to destroy the coccus, an insect which is at present damaging all our orchards. I know the application of spirits of turpentine will do it, without injuring the trees; it is by far the most easy and expeditious method for that purpose.

I am, Sir,

Your obedient servant,

SAMUEL CURTIS.

Walworth, Dec. 12, 1807.

To Charles Taylor, M. D. Sec.

Certificates from M. P. Carter, D. D. Rector of Bradwell, and Mr. Thomas Fairhead, Churchwarden, confirmed that Mr. S. Curtis had planted about four thousand standard fruit trees on about forty-eight acres of land, and that the same were, on the 7th of April, 1808, in a thriving condition.

SIR,

THE certificate I sent you relative to my orchard, stated the number of trees to be about four thousand, but the real number is 4620 trees. I am sorry to have occasion to notice to you a disease in pear trees, almost as destructive, although not so frequent as that I mentioned to be produced from the insect on apple trees. This upon pear trees appears as a dry rotten scab, which keeps increasing until it penetrates even the hard wood, and as it proceeds surrounds the limb entirely. The following spring the limb dies from the diseased part upwards. I have not found any insect to be concerned in this disease, which frequently takes place upon the trees of most luxurious growth. Its commencement seems to be from the thick rind of the tree becoming spongy; it then begins to crack and look scabby, the inner bark becomes dark coloured, and the disease proceeds until the destruction of the limb takes place. Some particular sorts of pear trees are with me much more liable to this disease than others: Windsor, autumn, bergamots, Catharine pears, &c. I suspect the disease to arise in a great measure from the soil.

My new orchard is situated at Glazen Wood, near Coggeshall, in Essex. I think myself highly honoured by the inquiries of her Serene Highness the Margravine of Anspach concerning it. As her Highness has attended to the pruning of fruit trees both in England and on the Continent, doubtless she is aware of the existing diseases in apple and pear trees,—any easy remedy for them would be of immense consequence; and if her Highness can furnish any discovery relative thereto, it would confer a great service on the p lic, and be esteemed by me a very particular obligation and honor.

I remain, Sir,

Your obedient Servant,

SAMUEL CURTIS.

Glazen Wood, near Coggeshall,
June 3, 1808.

To C. Taylor, M. D. Sec.

The Silver Medal *of the Society was this Session voted to Mr.* Richard Parkinson, *of Walworth, near London, for his Method of curing the Foot Rot in Sheep. The following Communications were received from him.*

SIR,

The inclosed is the recipe for the cure of the foot rot in sheep, certified by the person who was my shepherd at the time I put the method into practice.

I am, Sir,

Your very obedient Servant,

R. PARKINSON.

18, *Harford Place, Walworth,*
April 6, 1807.

To C. Taylor, M. D. Sec.

To

To Cure the Foot Rot in Sheep in the best and most effectual Manner.

In sheep thus affected, pare their hoofs, leaving no hollow to hold dirt; if there be matter formed, be particularly careful to let it out; after which, take some stale urine and wash their feet clean from dirt, and wipe them with a sponge; then put the sheep into a house or shed, the floor of which has been previously spread about two inches thick with quick lime, reduced to powder by a small quantity of water. The fresher the lime is from the kiln the better. Let the sheep stand upon it for six or seven hours, and the cure will be effected.

A Certificate, dated March 27, 1807, from Joseph Dunnington, stated his being shepherd to Mr. Parkinson, at Slane in Ireland, in the year 1803, and that he then witnessed the efficacy of the above remedy on a large flock of sheep.

Further Certificates from the Earl of Conyngham, from Mr. Stephen Parkinson, and from Joseph Preston, shepherd to Mr. John Parkinson of Bolingbroke, confirmed the above statement.

The SILVER MEDAL *of the Society was this Session voted to* Mr. W. WALLIS MASON, *of Goodrest Lodge, near Warwick, for his Method of Stabbing Hoven Cattle, to discharge the Rarified Air from the Stomach, when they have been overfed with moist Clover Grass. The following Communications were received from him.*

GENTLEMEN,

I BEG leave to lay before you a trocar and canula, for the relief of cattle, when gorged or hoven. Since I have introduced it, it has been used with the greatest success, having, in every instance tried, been proved a safe, easy, and effectual remedy.

I consider it will not be necessary for me to detail the dangerous consequences arising from cattle being hoven, as it is well known that the public are annually deprived of numbers of valuable cattle by this disorder. I am inclined to offer it as an instrument superior to that, for which the Society granted a premium in the year 1796, as I am of opinion that flexible tubes may be forced down the ventricle which conducts to the lungs, by which most dangerous consequences would ensue. An instance of this kind occurred last year in this neighbourhood, when intending to force the passage of the paunch, and occasioned the loss of the animal.

Neither the farmer or bailiff can be expected, when going the rounds of the farm, to carry with him at all times an instrument so large as one of the flexible tubes; even if he had it, he could not make use of it without the assistance of a second person, and the disorder would be fatal in most instances, before such assistance could be procured.

I considered that the trocar and canula, commonly used by surgeons, might be employed to advantage for the relief of hoven cattle. I have improved the instrument, to answer better the purpose here intended of penetrating the tense hides of cattle, and such alteration materially facilitates the operation.

The method of applying it is, to penetrate with the trocar and canula through the hide of the beast, to the paunch on the near side, about six inches from the back-bone, at an equal distance from the last rib, and from the hip-bone; then to withdraw the trocar, and to leave the canula in the wound, until the air which the paunch contained has escaped. The canula may then be taken out, and the wound covered with a plaster of common pitch, spread on brown paper, about the size of a crown piece. All the danger incidental to the common mode of stabbing with the knife is effectually prevented, by the canula being left in the incision when the trocar is withdrawn.

The small expense of the instrument, its portability, the ease with which it can be used by an individual, its safety and efficacy in use, as it has not in any instance failed of complete success, will, I hope, be sufficiently evident to recommend it to the attention of the Society. A great saving would arise to the owners of cattle, and to the country at large, from general adoption of its use.

A feeding ox will thrive as well after the operation as if it had never been affected by the disorder. Cows in calf are in no danger from its use. It has been found particularly beneficial in preserving rearing calves, and young cattle, when afflicted with this disorder, which had heretofore been fatal to great numbers of them.

I beg leave to add the certificates of a few of those gentlemen who have witnessed the utility of this method, and whose recommendations have stimulated me to submit it to the Society, in hopes, that by their liberal patronage, it may be rendered more generally beneficial to the public.

I have the honour to remain, Gentlemen,
Your obedient Servant,
W. WALLIS MASON.

Goodrest Lodge, near Warwick,
February 24th, 1808.

Certificates from the following gentlemen, testified that they had experienced the validity of Mr. Mason's trocar, had proved the safety of the operation, and the instantaneous relief which it had never failed to produce without leaving any blemish, or dangerous consequence, from its application.

JOHN FOORD NAISH, Leek Wootton.
THOMAS BRYAN, Warwick.
WILLIAM ORAM, Warwick.
WILLIAM LEDROOKE, Northend.
RICHARD CATTELL, Milverton.

To the Society of Arts, &c.

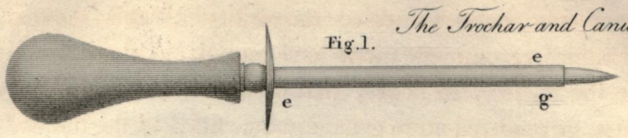
Reference to the Engraving of Mr. WALLIS MASON'S *Trocar and Canula.*

Fig. 1, Pl. 1, is a representation of Mr. Wallis Mason's trocar and canula. The blade of the trocar is of steel *aa,* fig. 4, fixed into a wooden handle *bb.* The shape of the blade of the trochar is oval, as shown in the end view of the canula, fig. 3. The canula or sheath *ee,* figs. 1 and 2;

M^r. Mason's Trochar for relieving Hoven Cattle.

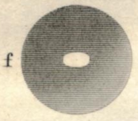
The Trochar and Canula.

Fig.1.



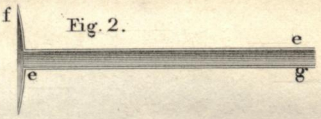
End view of the Canula.

Fig.3.



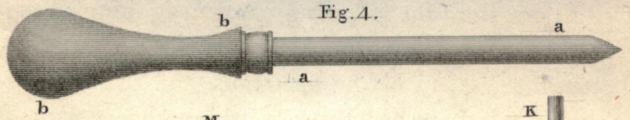
Section of the Canula.

Fig. 2.



Trochar by itself.

Fig.4.



M^r. I. Fisher's improv'd Churn Staff.

Fig.5.

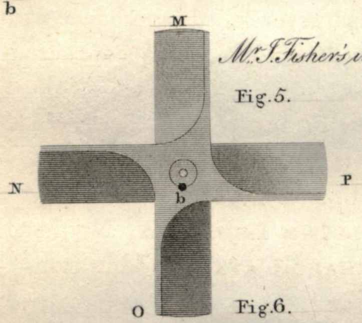


Fig.6.

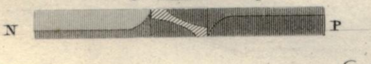
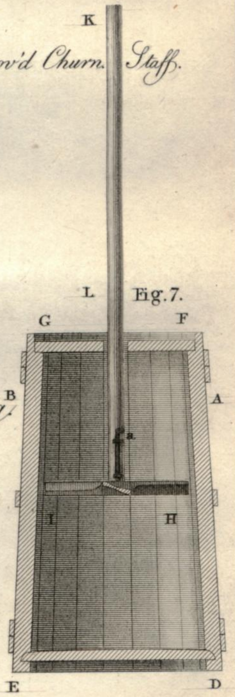


Fig.7.



M^r. Tansley's method of cutting Shag.

Fig.8.

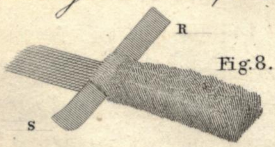


Fig.9

I. Farey, Jun^r. del.

Engraved by S. Porter.

2, is an oval tube, which exactly fits the blade of the trocar; *ff* is a concave circular plate, fixed at the end of the canula, forming a hilt, to prevent the instrument from giving too deep a wound when used; the end *g* of the canula is worked down to a sharp edge, that it may not obstruct the passage of the instrument. The drawings are on a scale of one inch to two inches and a half; in figs. 1 and 2, the trocar and canula are shown edgeways, or in the shortest diameter of the ellipsis; in fig. 4, the trocar is shown flat, in its longest diameter.

FIVE GUINEAS *were this Session voted to Mr.* TIMOTHY FISHER, *of Ormskirk, Lancashire, for a Swivel-headed Churn Staff, to facilitate the making of Butter. The following Communications were received from him.*

SIR,

I BEG leave to lay before the Society of Arts, &c. my swivel-headed churn staff, which, on repeated trials, is now fully proved to answer the very desirable purpose of relieving the hard labour of churning, which it does in a much greater degree than could be supposed, from a slight view of its simplicity and apparent small deviation from the common churn staff. It however passes with much more ease through the cream. It must be worked much slower than the common, otherwise it is found to churn the cream too soon, or, according to the technical term in this county, *to swelt it.*

I have tried it in a variety of forms and sizes: with six wings the labour was less relieved; also when I gave less bevel to the ends of the wings.

When I gave more bevel it passed through without producing the intended effects. Experience therefore has convinced me, that it is best to have four wings from six to seven inches in length, from the centre, according to the size of the churn for which it is intended, from two and a half to three inches in breadth, made plane in the centre or middle, about the fourth part of their length, and then bevelled regularly off, so that the extreme point shall form an angle of about 45 degrees with the plane of the middle. The plane part acts with its usual force upon the middle of the body of the milk; and the points turning rapidly round, give a kind of compound motion to the whole, and that also alternate, and yet it does not in the least splash or throw out the cream as in the common mode.

The small bolt at the side, which I make of wood, is to lock the head, and prevent the wings from turning round whilst the butter is collected from the milk when the operation of churning is completed.

I am, Sir,

Your obedient Servant,

TIMOTHY FISHER,
Gun-maker.

Ormskirk, Lancashire, May 1st, 1808.

To C. Taylor, M. D. Sec.

Thomas Eccleston, Esq. of Scarisbrick Hall, near Ormskirk, certified, that he had seen Mr. Fisher's new method of churning butter, and that he thinks it superior to any he had heretofore known for that purpose, and that such was also the opinion of several other persons in the farming line who had witnessed its effects.

Reference to the Engraving of Mr. Fisher's *Churn Staff.*

Fig. 7, Pl. 1, is a section of an upright churn, in the situation it would be when at work, and figs. 5 and 6 are enlarged views of the head of the churn staff. ABDE fig. 7, is a section of the churn; FG is the lid; KL is the churn staff, and HI the wings, or beaters; it is this part only which differs from the ordinary churn; it consists of four wings or vanes MNOP, fig. 5, firmly fixed together, and turning freely on a pin driven into the end of the churn staff. The flat part of each vane is cut, so as to be inclined to the plane in which all four lie, in the same manner as the sails of a windmill, as is well explained by figs. 5 and 6. When the beater is moved up and down through the cream, its action upon the oblique vanes causes it to turn round upon a pin above mentioned, as a centre. *a*, Fig. 7, is a small bolt sliding in a groove made in the churn staff, KL; its ends shut into a hole *b*, fig. 5, made in one of the vanes; when this bolt is pushed down, it prevents the vanes from turning round, for the purpose of collecting the butter together at the top of the butter-milk when the churning is done.

PAPERS